CORPS OF ENGINEERS, U. S. ARMY

SALT WATER INTRUSION, CALCASIEU RIVER, LOUISIANA AND CONNECTING WATERWAYS

MODEL INVESTIGATION

TECHNICAL MEMORANDUM NO. 2-310

WATERWAYS EXPERIMENT STATION

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Frontispiece. Port facilities at Lake Charles, La., looking north. U.S. Highway 90 bridge over Calcasieu River in center, city of Lake Charles at upper right.

PREFACE

This report contains the results of a model study of salt-water intrusion in the Calcasieu River, Louisiana, and connecting waterways. The study was initiated by the Division Engineer, Lower Mississippi Valley Division, CE, and was authorized by the Chief of Engineers, CE, U. S. Army, on 22 November 1944.

Prior to undertaking the model study engineers of the Waterways Experiment Station inspected the prototype, laid out a field data-collection program, and assisted in the obtaining of field data for adjustment and verification of the model. Numerous conferences were held between representatives of the Waterways Experiment Station and the Lower Mississippi Valley Division prior to and during the course of the study, and semimonthly progress reports were submitted to the Division Engineer detailing the progress made.

The model study was conducted by the Hydraulics Division of the Waterways Experiment Station. Engineers actively connected with the study were Messrs. G. B. Fenwick, H. B. Simmons, and H. J. Rhodes, Jr. Mr Rhodes was directly in charge of the study, and actively participated in the field surveys to obtain data for adjustment of the model.

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SUMMARY

Hydraulic model investigations were conducted to determine the effects of past and proposed deepenings of the Calcasieu River channel below Lake Charles, Louisiana, upon the intrusion of salt water from the Gulf of Mexico into the Calcasieu River and connecting waterways. A fixed-bed model constructed to scale ratios of 1:1000 horizontally and 1:50 vertically was used for the investigation.

The results of the model investigation indicated that the deepening of the river channel to 30 ft in 1940-41 caused large increases in salinity in the Calcasieu River and the Calcasieu River-Mermentau River section of the Gulf Intracoastal Waterway. The study also indicated that the proposed deepening of the existing 30-ft channel to a 34-ft depth would cause further general increases in salinity in the Calcasieu River and the Intracoastal Waterway, particularly during periods of net eastward flow in the latter; however, during periods of net westward flow or reversing tidal flow in the Intracoastal Waterway, such channel deepening would have negligible effect on salinity intrusion therein.

SALT WATER INTRUSION, CALCASIEU RIVER, LOUISIANA AND CONNECTING WATERWAYS

Model Investigation

PART I: INTRODUCTION

The Problem

1. The problem with which the investigation reported herein was concerned was to determine the effects of past and proposed channel dredging on salinity intrusion from the Gulf of Mexico into the lower Calcasieu River, the upper Calcasieu River, and the Calcasieu River-Mermentau River section of the Gulf Intracoastal Waterway

2. Prior to 1941 the deep-water outlet from the Port of Lake Charles, Louisiana, was by the Calcasieu River to mile 21.9, thence westward through the Lake Charles Deepwater Channel to the Sabine River at Orange, Texas, thence down the Sabine River to the Gulf of Mexico, a total distance of 79 miles (see fig. 1, opposite page 2). In 1941, as a result of increasing shipments of oil and high octane gasoline from the Port of Lake Charles, a channel 30 ft deep at Gulf mlw with a bottom width of 250 ft was dredged through Calcasieu Lake and Calcasieu Pass to the Gulf, thus shortening the route from the Port of Lake Charles to the Gulf by 44 miles. This channel, however, proved inadequate for modern tankers built during the recent war, and a proposal was made for further improvement of the channel by dredging it to a depth of 34 ft.

3. This proposal met considerable opposition from the rice growers of the Mermentau River Basin, which is located roughly parallel

to and about 25 miles to the east of the Calcasieu River. The rice growers contended that dredging the existing 30-ft channel increased salinity intrusion from the Gulf into the Calcasieu River and thus effected large increases in the salinity of the water passing from the Calcasieu River through the Intracoastal Waterway to the Mermentau River, from which water is pumped for irrigation purposes. They also contended that the proposed channel deepening would effect further increases in the salinity of the irrigation water, and thus result in a considerable loss to rice growing interests.

4. Prototype data relative to the salinity of the water throughout the area under investigation were not available in sufficient quantity to show conclusively the effects of dredging the present 30-ft channel in 1940-41, or to provide a dependable basis for predicting the effects of deepening the existing channel to 34 ft. It appeared, therefore, that a model study was the only means of providing data upon which dependable conclusions could be based.

5. In addition to the Gulf of Mexico, other sources of salt which may contribute to contamination of the waters of the Calcasieu River and tributary streams are the numerous oil and gas fields throughout the area and industrial wastes dumped into the streams for disposal. Data supplied by the State of Louisiana Department of Conservation indicate that all oil wells in the Calcasieu River area produce approximately twice as much salt water as oil, the total salt-water production amounting to about 302,000 cu ft per day and having salinities ranging from 42,000 to 143,000 parts per million chlorides. Also, the Mathison Alkali Works produce about 200,000 cu ft of waste per day which, when dumped into the river for

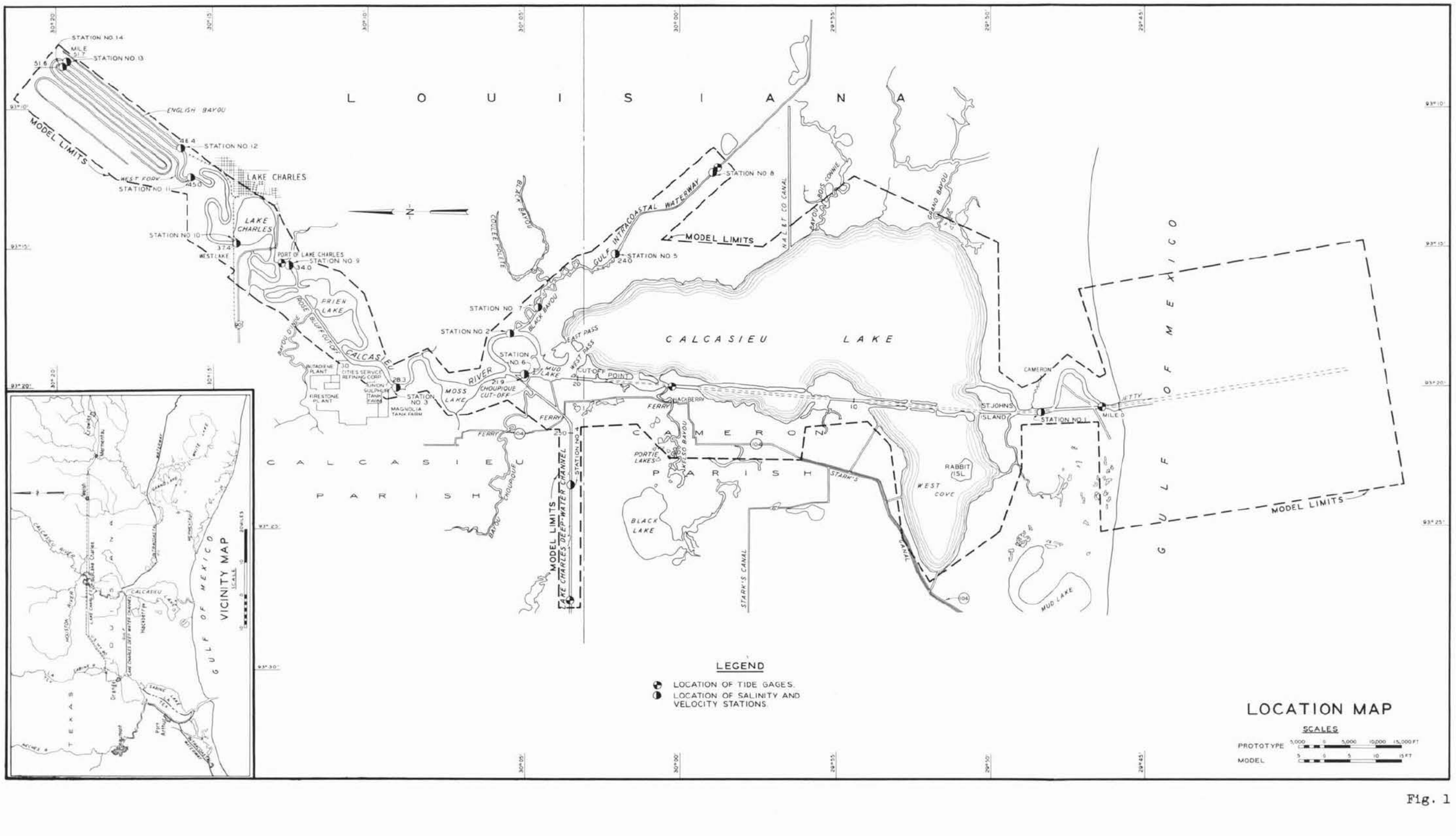
LOUISIANA
CALCASIEU PARISH
CAMERON PARISH
CALCASIEU LAKE
GULF OF MEXICO
STATION NO. 14
MILE 51.7
STATION NO. 13
51.6
ENGLISH BAYOU
MODEL LIMITS
46.4
STATION NO. 12
WEST FORK
STATION NO. 11
45.0
LAKE CHARLES
LAKE CHARLES
STATION NO. 10
37.4
WEST LAKE
PORT OF LAKE CHARLES
STATION NO. 9
34.0
ROSE BLUFF CUTOFF
FRIEN LAKE
BAYOU DIXIE
CALCASIEU RIVER
BUTADIENE PLANT
30
CITIES SERVICE REFINING CORP.
28.3
UNION SULPHUR TANK FARM
STATION NO. 3
MAGNOLIA TANK FARM
FIRESTONE PLANT
MOSS LAKE
21.9
CHOUPIQUE CUT-OFF
STATION NO. 6
MUD LAKE
STATION NO. 7
STATION NO. 2
BLACK BAYOU
DOUBLE POINTE
GULF INTRACOASTAL WATERWAY
STATION NO. 8
MODEL LIMITS
M.L. & T. CO. CANAL
STATION NO. 5
24.0
EAST PASS
WEST PASS
CUT-OFF POINT
BLACKBERRY FERRY
FERRY
FERRY
STATION NO. 4
25.0
MODEL LIMITS
LAKE CHARLES DEEP WATER CHANNEL
CHOUPIQUE BAYOU
PORTIE LAKES
BLACK LAKE
STARK'S CANAL
STARK'S
WEST COVE
RABBIT (15L)
CANAL
BAYOU NOS CONNIE
GRAND BAYOU
CAMERON
ST. JOHNS ISLAND
STATION NO. 1
MILE 0
JETTY
MODEL LIMITS
MUD LAKE
VICINITY MAP
SCALE
TEXAS
LOUISIANA
GULF OF MEXICO
LEGEND
LOCATION OF TIDE GAGES.
LOCATION OF SALINITY AND VELOCITY STATIONS.
LOCATION MAP
SCALES
PROTOTYPE
MODEL

Fig. 1

disposal, has an average salinity of approximately 40,000 parts per million chlorides. The above-discussed wastes are not dumped directly into the stream as they are produced; instead, the wastes are impounded and released into the stream only during favorable conditions of flow and, if possible, during times at which pumping for irrigation purposes is at a minimum.

6. Inasmuch as the primary purpose of the model study was to determine the effects of the proposed channel deepening on salinity intrusion from the Gulf of Mexico, and since disposal of industrial and other wastes is not accomplished on a definite schedule, no attempt was made to reproduce or study in the model possible contamination of the streams by waste products. Therefore, the results and findings presented in this report apply only to salinity intrusion from the Gulf of Mexico, and can not be interpreted as absolute salinity values in the prototype since prototype salinities may or may not be further increased by disposal of waste products in the streams.

The Prototype

Location

7. The Calcasieu River rises in Vernon Parish, in western Louisiana, and flows about 215 miles in a southerly direction to the Gulf of Mexico, traversing and draining with its tributaries the larger part of the Parishes of Vernon, Rapides, Beauregard, Allen, Calcasieu, Jefferson Davis, and Cameron (see fig. 1). The river is roughly paralleled to the eastward at a distance of about 25 miles by the Mermentau River, and to the westward at a distance of from 25 to 50 miles by the Sabine River,

which forms the boundary between Louisiana and Texas. The mouth of the Calcasieu River is about 30 miles east of the mouth of the Sabine River and about 250 miles west of Southwest Pass of the Mississippi River.

Economic value of Calcasieu River

8. The Port of Lake Charles serves that portion of Louisiana west of Vermillion and south of Alexandria. Typical facilities of the port area are shown on fig. 2 and the frontispiece. In normal times this area is largely an agricultural one, its principal products being rice, cotton, sugar cane, feed products, and live stock. Within this area lie 32 (1941 figure) actively worked oil fields producing large quantities of crude oil and natural gas. Throughout the local tributary area, as far

Fig. 2. Vincent Landing on Calcasieu River about 6 miles south of Lake Charles. A sulphur tank farm is in foreground, refining company beyond.

as Alexandria, there are numerous feed mills, rice mills, cotton gins, syrup mills, and one large naval stores plant, the products of which are delivered in part by motor truck to the ship terminals at Lake Charles. During the five years prior to 1942, a yearly average of 4,500,000 tons of freight passed through the waterways affected by the model study herein discussed, and through the terminal and transfer facilities contiguous thereto.

9. Within the area served by the Port of Lake Charles the Army, during the recent war, located many camps and airfields for training troops, thereby considerably magnifying the importance of the port. The port is served by three class-one railroads. The Lake Charles Harbor and Terminal District has expended about $1,900,000 in constructing public terminals. In addition, there are many privately-owned facilities in the vicinity of Lake Charles.

Physical characteristics

10. The Calcasieu River differs from the majority of streams discharging into the Gulf of Mexico in that there is no well-defined bar at its mouth. The river is not a heavy silt-bearing stream, however, and it is probable that the small amount of silt transported is deposited in the system of connecting lakes which characterize its lower reaches.

11. Calcasieu Lake, which lies just above Calcasieu Pass, is about 15 miles long and from 3 to 12 miles wide. With the exception of the dredged channel through the lake, its greatest depth is about 7.5 ft and its controlling depth about 5.5 ft. The section of the river from Calcasieu Lake to the Gulf, a distance of about 7.75 miles, is known as

Calcasieu Pass. The river channel throughout this reach averages about 700 ft in width and, prior to dredging the existing navigation channel, depths ranged from 12 to 40 ft.

12. Between the lower end of Lake Charles and the upper end of Calcasieu Lake the river flows about 27 miles in its sinuous natural channel, passing successively through Prien, Moss, and Mud Lakes. Three cutoffs have reduced the length of the navigation channel through this reach to about 19.5 miles.

13. The Lake Charles Deepwater Channel, a 30-ft-deep by 125-ft-wide navigation channel, leaves the Calcasieu River at a point about 1.25 miles below Moss Lake and passes through Chopique Cutoff for a distance of about 3.0 miles, and thence westerly for a distance of about 22 miles to the Sabine River along the route now followed by the Calcasieu River-Sabine River section of the Intracoastal Waterway. The Mermentau River-Calcasieu River section of the Intracoastal Waterway, which is 12 ft deep by 125 ft wide, joins the Calcasieu River through Black Bayou at a point about 1.5 miles east of the head of Chopique Cutoff.

Prototype Data

14. While numerous salinity samples had been obtained throughout the area affected by the problem discussed herein, they were neither comprehensive nor correlated to the extent of furnishing sufficient data for adjustment and verification of the model. It was therefore necessary to make a new survey, which was accomplished by personnel of the New Orleans District, CE, working in cooperation with representatives of the Waterways Experiment Station. This survey consisted of obtaining prototype

measurements of tidal heights, current velocities, salinities, and fresh-water discharges for a period of about two weeks in order to provide complete and dependable data on which to base the model adjustment and verification.

15. Salinity and current velocity observations were made at surface, mid-depth, and bottom at six selected stations throughout the area reproduced in the model. The locations of salinity and velocity observation stations are shown on fig. 1 (opposite page 2) and were as follows: (a) station 1, in Calcasieu Pass opposite Cameron, Louisiana; (b) station 2, in the Calcasieu River opposite the mouth of Black Bayou; (c) station 3, in the Calcasieu River about 2.0 miles above the head of Moss Lake; (d) station 4, in the Calcasieu River-Sabine River section of the Intracoastal Waterway about 5.0 miles west of the Calcasieu River; (e) station 5, in the Calcasieu River-Mermentau River section of the Intracoastal Waterway about 5.0 miles east of the Calcasieu River; and (f) station 6, in the Calcasieu River Ship Channel between Mud Lake and the head of Chopique Cutoff.

16. Recording tide gages were installed in the Calcasieu River at Cameron, Hackberry, and Lake Charles; in the Calcasieu River-Mermentau River section of the Intracoastal Waterway at a point approximately 11 miles east of the Calcasieu River and at the entrance of the Waterway into the Mermentau River; and in the Calcasieu River-Sabine River section of the Intracoastal Waterway at a point about 9.0 miles west of the Calcasieu River. The locations of the tide gages, with the exception of that located at the entrance of the Intracoastal Waterway into the Mermentau River, are shown on fig. 1 (opposite page 2). Tide recordings at all

gages were obtained for the duration of the survey.

17. Daily measurements of fresh-water were obtained in all streams tributary to the Calcasieu River by personnel engaged in the field survey. Discharge measurements in the Calcasieu River were obtained daily by personnel of the U. S. Geological Survey at the U.S.G.S. discharge station near Kinder, Louisiana, and were furnished the Waterways Experiment Station for the period covered by the survey.

18. Field data described in paragraphs 15-17 were correlated and prepared for model use by personnel of the Waterways Experiment Station. Results of the field data collection are described in paragraphs 29-31, and significant data obtained are presented on plates 1-13.

PART II: THE MODEL

Description

Area reproduced

19. The Calcasieu River model was a scale reproduction of approximately 355 sq mi of prototype area as shown on fig. 1, opposite page 2. The area reproduced included a portion of the Gulf of Mexico adjacent to the mouth of the Calcasieu River, Calcasieu Pass and Calcasieu Lake, about 10 mi each of the Calcasieu River-Mermentau River and Calcasieu River-Sabine River sections of the Intracoastal Waterways, and the Calcasieu River in its natural channel from the head of Calcasieu Lake to a point about 5.0 mi above the city of Lake Charles. From this point northward the Calcasieu River, the Houston River, and English Bayou were reproduced in the form of labyrinths to the head of tidal influence in each stream. Fig. 3 is a view of a section of the model.

Fig. 3. Typical section of the model

Type of model

20. The model was of the type used for salinity investigations, provisions being made for reproducing prototype tides, tidal currents, salt-water movement, and fresh-water discharges throughout the area under study. Tides and tidal currents were reproduced by automatic tide controls, and fresh-water discharges were measured by Van Leer weirs and introduced into the model at the upstream limits of the streams reproduced. Salt water for filling the Gulf of Mexico portion of the model, and for reproducing tides therein, was stored in an underground sump which was equipped with a mixing system for adjusting and maintaining the proper salinity. All channel and overbank areas of the model were molded in concrete, and the various channel conditions for which tests were desired were molded in movable blocks so that channel depths could be altered easily.

Scale ratios

21. The model was constructed to linear scale ratios, model to prototype of 1:1000 horizontally and 1:50 vertically, with a resultant slope scale of 20:1. Other scale ratios, computed directly from the linear scale ratios, were: area, 1:50,000; volume, 1:50,000,000; velocity, 1:7.07; discharge, 1:353,500; and time, 1:141.44. The salinity scale required for reproduction of salt-water movement was 1:1.

Appurtenances

Tidal equipment

22. An automatic tide control* was used for reproducing the correct

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* This apparatus is described in detail in paragraphs 16-18 of Waterways Experiment Station Technical Memorandum No. 2-244, "Plans for the Improvement of the St. Johns River, Jacksonville to the Atlantic Ocean; Model Investigation."

tides and tidal currents in the model. The apparatus was equipped with a recording device which permitted a visual check on the accuracy of the tide reproduction at all times.

23. Discharge conditions in the Mermentau, Calcasieu, and Sabine Rivers control the direction and magnitude of flow in the Intracoastal Waterway throughout that reach of the Waterway involved in the model investigation, tidal flow in the Waterway being comparatively small. Since flow in the Waterway is sometimes eastward and sometimes westward, it was necessary to install, at the eastern and western limits of the model Waterway, tide gates which moved up or down as controlled by cams synchronized with the master tide control, thus automatically reproducing observed eastward or westward flows through the Waterway. During tests in which constant flows, either to the east or to the west, were reproduced, discharges in the model Waterway were carefully controlled by means of Van Leer weirs.

Gages

24. Water-surface elevations were ascertained at half-hour intervals by means of point gages so graduated as to permit reading to the nearest 0.001 ft in the model, which corresponded to 0.05 ft in the prototype. Permanent gages were located in the model to correspond to prototype gages located at Cameron, Hackberry, Lake Charles, mile 11 east of the Calcasieu River in the Calcasieu River-Mermentau River section of the Intracoastal Waterway, and mile 9 west of the Calcasieu River in the Calcasieu River-Sabine River section of the Intracoastal Waterway (fig. 1, opposite page 2).

Current meter

25. Model current velocity measurements were obtained with a small current meter developed for this purpose at the Waterways Experiment Station. The meter consisted of five small cups, about 0.02 ft in diameter, mounted on a vertical phonograph-needle shaft set in jeweled bearings. One of the five cups was painted bright red so that the number of revolutions of the meter in a given time interval could be easily counted. Revolutions per second of the meter were transferred to prototype velocity by means of a calibration curve. Calibration of the meter was checked at regular intervals to insure its correct operation.

Salinity measuring equipment

26. The salinity of model samples was determined by means of chemical titration with silver nitrate. This method involves adding a known concentration of silver nitrate to a known volume of sample until all salt in the sample is precipitated. The volume of silver nitrate required to precipitate all salt in the sample is the index to the original salinity of the sample.

General Procedure for the Study

27. After construction of the Calcasieu River model, the study was divided into two distinct phases: (a) adjustment of the model, and verification of its accuracy in reproducing known prototype phenomena; and (b) testing of the various channel conditions for which information was desired. Adjustment and verification of the model consisted of adjusting the tide control and the degree of model roughness until observed prototype tides and currents were reproduced throughout the model, then verifying

the known movement of the salt-water wedge for known conditions of tide and river discharge. When this had been accomplished, testing of the various channel conditions for which information was desired was undertaken.

PART III: ADJUSTMENT AND VERIFICATION

Conditions to be Reproduced

28. The value of a model study of this type is dependent upon the ability of the model to predict with a reasonable degree of accuracy the results which can be expected to occur in its prototype under conditions similar to those established in the model during tests of proposed improvement plans. It is desirable, therefore, that the model demonstrate its ability to reproduce known prototype phenomena before tests of conditions other than those existing in the prototype are undertaken. For the Calcasieu River model, the principal factors requiring adjustment were the automatic tide control and the degree of model roughness. Reproduction of salt-water movement in the model was the resultant of the tide and current adjustment, plus introduction of the proper fresh-water discharge into the upstream end of the model and maintenance of the correct salinity in the simulated Gulf of Mexico.

29. The Gulf of Mexico tide selected for reproduction in the model was of the typical one-a-day type and had a range of about 2.25 ft. This type of tide in the Gulf is commonly known as a "great declination" tide, since such tides occur when the moon reaches its greatest north or south declination. The range of tide at such times is appreciably greater than when the moon is near the equator. The reason for selecting a tide of maximum range was to obtain the greatest possible tidal influence throughout the area under investigation; furthermore, it was considered probable that the long high-water stand of this type of tide would cause the maximum intrusion of salt water from the Gulf into the Calcasieu River and

connecting waterways. Due to the relatively small channel through Calcasieu Pass, and to the large area of Calcasieu Lake, the range of tide in Calcasieu Lake and in the river upstream therefrom is very small. With a Gulf tidal range of 2.25 ft, the range of tide at the north end of Calcasieu Lake is about 0.6 ft, while at Lake Charles the range is only 0.3 ft.

30. For a Gulf tide range of 2.25 ft, current velocities in Calcasieu Pass are fairly strong. Maximum ebb velocities in the Pass range from about 4.0 ft per sec on the bottom to about 5.0 ft per sec at the surface, while maximum flood velocities range from about 2.0 ft per sec on the bottom to about 3.4 ft per sec at the surface. Throughout Calcasieu Lake and the river upstream from the lake, however, current velocities rarely exceed about 1.0 ft per sec. For fresh-water discharges of about 1,000 cfs or more, the surface current in the river upstream from Calcasieu Lake does not reverse with tidal phase, the direction of flow being toward the Gulf at all times. For extremely low fresh-water discharges, there is a short period of reversing flow as far upstream as Lake Charles.

31. Salinities throughout the area under investigation were found to be quite low at the time of the field survey, because of the comparatively large fresh-water discharge (11,000 cfs) at that time. Maximum salinities at stations 1, 2, and 3 were about 13,000 parts per million, while in the Intracoastal Waterway, both east and west from the Calcasieu River, the maximum salinity found was less than 500 ppm. Salinities throughout the river vary widely during the year, being greatest during the late summer months when fresh-water discharges are lowest, and least

in late winter and early spring during the rainy season. Prolonged periods of heavy rainfall and high fresh-water flows will cause the salt-water wedge to be pushed downstream to the lower end of Calcasieu Lake, and in extreme cases it is probable that no salt water could be found north of Calcasieu Pass. Salinity conditions during the summer months are aggravated by the removal of large volumes of fresh water from the streams for irrigation purposes. It is probable that at certain times the volume of water being pumped for irrigation exceeds the fresh-water discharge of the river.

Adjustment Procedure

Tides and currents

32. Adjustment of the automatic tide control was accomplished through a cut-and-try process of regulating the amount of up-or-down movement of the motorized valve for each portion of the tidal cycle. When the correct setting for the valve movement had been found, the mechanism accurately reproduced the observed prototype tides throughout the course of the study.

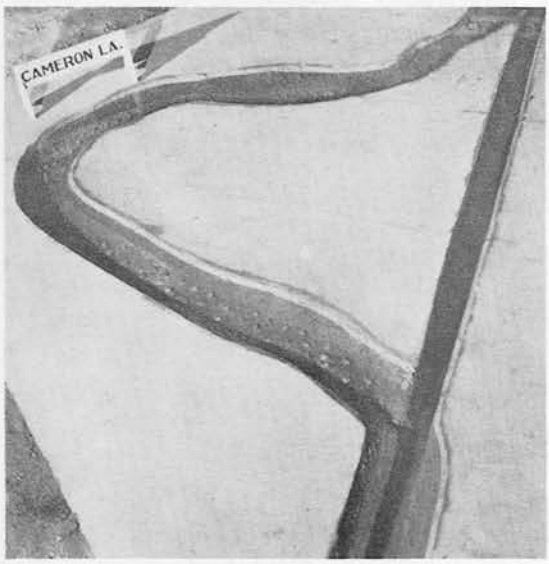


Fig. 4. Desired roughness obtained by use of stucco and gravel

33. Following completion of the tidal adjustment for the Gulf of Mexico portion of the model, it was necessary to add roughness to the model channels (in the form of stucco and small gravel, see fig. 4) so that the proper water-surface slope, current velocities, and distribution of

flow would be reproduced at all times throughout the tidal cycle. This procedure was necessary since the smooth concrete bed of the model would not produce the same frictional effects as the natural channels in the prototype. Since sufficient prototype data were available to check the model adjustment, the roughness factor was not computed, roughness being added to the model through a cut-and-try process until tidal heights and current velocities therein conformed to those measured in the prototype.

Salinity

34. After hydraulic adjustment of the model (tides, current velocities, and distribution of flow) had been completed, the simulated Gulf of Mexico was filled with water having a salinity of 34,000 ppm, the maximum salinity measured in that area during the prototype data-collection survey. The river system was filled with fresh water, the two bodies of water being separated by a movable dam located at about station 1 in Calcasieu Pass. The tide control was then started, the river inflow weirs adjusted to introduce the proper discharges, and the movable dam separating the salt water and the fresh water removed.

35. Prototype salinity conditions in the Calcasieu River represent a balance between the forces of fresh water and of tidal flows. In the model, where the fresh- and salt-water bodies were separated at the beginning of a test, it was necessary to operate the model for a considerable period of time before the forces could adjust themselves properly for the conditions of the tide and fresh-water discharge reproduced. This adjustment of forces was considered to have been attained when the salt-water wedge in the model reached its maximum penetration into the river

for the fresh-water discharge being reproduced. It was found during salinity adjustment tests that when the salt-water wedge reached its maximum penetration for any given fresh-water discharge, the location of the wedge would remain stable for several hours thereafter, thus allowing sufficient time for obtaining all necessary salinity samples from the model.

36. It will be noted from the above discussion that reproduction of salt-water movement in the model required no special adjustment, this movement resulting automatically from accurate reproduction of tides and currents, maintenance of the proper salinity in the simulated Gulf of Mexico, and introduction of the correct fresh-water discharge.

Results

37. The results of the model verification test are shown on plates 1-13 and in table 1. This test was repeated several times to demonstrate that the model results were consistent; however, since the results of all tests were almost identical, the results of one test only are plotted with corresponding prototype data.

38. The curves indicating prototype tides, current velocities, and salinities on the above-mentioned plates are actual prototype values as measured during the field survey of 11-27 January 1945. At station 1, a continuous record of velocities and salinities was obtained for the entire 16-day period; at other stations, measurements were limited to one complete tidal cycle, repeated as often as limited personnel and equipment permitted. However, not less than two complete tidal cycles (24 hours each) of observations were obtained at each velocity and salinity station.

39. It may be noted that the salinity values shown on plates 8-13 and in table 1, both in the prototype and in the model, are quite low. This is due to the relatively high fresh-water discharge of the river during the period of prototype observations. Normally, salinities throughout the river are much higher as will be noted later in descriptions of model tests.

40. As shown in table 1, the model reproduced the average prototype salinity at each station and depth with a reasonable degree of accuracy. The only point at which an appreciable difference occurred between prototype and model salinity values was at station 3 at a depth of 31 ft. This discrepancy is attributed to the fact that, through an oversight during the field data-collection survey, samples at station 3 were not obtained near the bottom as was the case at other stations. The channel at this point is approximately 48 ft deep; therefore, it is probable that a variation of two or three feet in depth in either direction from the indicated depth (31 ft) would result in as great a difference in salinity as was found between the prototype and model.

41. At certain points on some of the salinity curves shown on plates 8-13, there are apparent discrepancies between prototype and model values. It must be kept in mind, however, that prototype salinity measurements were necessarily limited to samples obtained at hourly intervals for one tidal cycle, and since, due to limited personnel, it was impossible to obtain measurements at more than two stations simultaneously, prototype salinity observations for verification test conditions were actually obtained over a three-day period. Since the fresh-water discharge of the Calcasieu River was not stable during the

observation period, the change in fresh-water flow is reflected to some extent in the salinity measurements. In the model, however, it was possible to establish and maintain any desired flow condition for as long a period as desired. Therefore, model salinity measurements are truly representative of one isolated condition of flow, while prototype measurements have been affected somewhat by changing flow conditions.

42. As shown on plates 1-7, a satisfactory reproduction of prototype tidal heights and current velocities was obtained. With the one exception of the East Intracoastal Waterway gage (plate 2), tidal heights throughout the model did not vary by more than 0.2 ft from those observed in the prototype, and current velocities were also reproduced with sufficient accuracy. It may be noted on plates 4-7 that at certain stations, particularly those located upstream from the upper end of Calcasieu Lake, both prototype and model velocities were too low to measure.

43. Based upon the degree of accuracy with which the model reproduced the tidal heights, current velocities, and salinities of the prototype for the verification condition, it was felt that the model adjustment was satisfactory, thus insuring that the model would indicate accurately, during subsequent tests, the effects of past and proposed changes in channel conditions for which information was desired.

PART IV: NARRATIVE OF TESTS

Conditions Tested

44. Model salinity tests were made of three channel conditions in the Calcasieu River: (a) the existing ship channel, which has a project depth of 30 ft at Gulf mlw and an actual controlling depth of 27 ft from the Gulf of Mexico to the Port of Lake Charles; (b) the above-mentioned channel deepened to 34 ft at Gulf mlw; and (c) with the channels throughout the Calcasieu River restored to depths which obtained prior to dredging the existing ship channel in 1940-1941.

45. Since flow in the Calcasieu River-Mermentau River section of the Intracoastal Waterway is sometimes tidal (reversing with tidal phase), sometimes eastward, and sometimes westward, and since the freshwater discharge of the Calcasieu River varies appreciably throughout the year, it was considered advisable to conduct tests, for each channel condition, which would include the combinations of flow most likely to occur in the prototype. Accordingly, tests were made reproducing tidal flow, net eastward flow, and net westward flow in the Intracoastal Waterway, over a range of Calcasieu River discharges. The combinations of flows reproduced during the 27 tests conducted in the model are listed in table 2.

Procedure

46. At the beginning of each test the river and lakes upstream from station 1 were filled with fresh water and the Gulf with water having a salinity of 34,000 ppm, the two bodies of water being separated

by a dam at station 1. As described in paragraph 34, the dam was removed after the automatic tide control had been started and the fresh-water inflow weirs adjusted. The model was then operated for a sufficient length of time to allow stabilization of the salt-water wedge for the condition being reproduced.

47. When salinity conditions in the model had become stabilized, samples were obtained at all salinity stations for which information was desired. Samples at stations 1, 3, 5, 6, 7, and 8 were obtained at the surface, mid-depth, and bottom. Samples at station 2, located at the junction of Black Bayou with the Calcasieu River, were obtained at 6-ft intervals of depth, beginning at the surface and extending to the bottom. Samples at stations 9-14 were obtained at surface, one-fourth depth, one-half depth, three-fourths depth, and bottom.

Existing (30-ft) Channel

48. Tests 1-9 were made with the existing 30-ft channel installed in the model. Tests 1, 2, and 3 were conducted with tidal flow only in the Intracoastal Waterway and with Calcasieu River discharges of 500 cfs, 5000 cfs, and 7000 cfs, respectively. Tests 4, 5, and 6 reproduced a net eastward flow of 1000 cfs in the Intracoastal Waterway and Calcasieu River discharges of 500 cfs, 5000 cfs, and 7000 cfs, respectively. Tests 7, 8, and 9 were made with a Calcasieu River discharge of 500 cfs and net westward flows of 300 cfs, 500 cfs, and 800 cfs, respectively, in the Intracoastal Waterway. All tests of the existing channel were concerned with salinity intrusion in the lower Calcasieu River and in the Calcasieu River-Mermentau River section of the Intracoastal Waterway; no samples

were obtained in the upper Calcasieu and Houston Rivers during these tests.

49. The results of tests reproducing tidal flow only in the Intracoastal Waterway (tests 1-3) are presented on plates 14-31 and in table 3. With a Calcasieu River discharge of 500 cfs (test 1), maximum salinities at stations in the lower Calcasieu River were between 25,000 and 30,000 ppm, while the maximum salinity at station 5 in the Intracoastal Waterway was about 22,000 ppm. With a Calcasieu River discharge of 5000 cfs (test 2), maximum salinities in the lower river ranged from 22,000 to 27,000 ppm; however, the maximum salinity found in the Intracoastal Waterway was about 700 ppm. With a Calcasieu River discharge of 7000 cfs (test 3), maximum salinities in the lower river ranged from 22,000 to 28,000 ppm, while in the Intracoastal Waterway the maximum salinity was about 1300 ppm.

50. The results of tests reproducing net eastward flow in the Intracoastal Waterway (tests 4-6) are presented on plates 32-52 and in table 4. With a Calcasieu River discharge of 500 cfs and a net eastward flow of 1000 cfs in the Waterway (test 4), maximum salinities in the lower river ranged from 24,000 to 29,000 ppm, while the maximum salinity at stations 5 and 7 in the Intracoastal Waterway was about 23,000 ppm. With a Calcasieu River discharge of 5000 cfs and a net eastward flow of 1000 cfs in the Waterway (test 5), maximum salinities in the lower river ranged from 21,000 to 27,500 ppm, while maximum salinities in the Waterway ranged from 13,000 to 16,000 ppm. With a Calcasieu River discharge of 7000 cfs and a net eastward flow of 1000 cfs in the Waterway (test 6), maximum salinities in the lower river ranged from 21,500 to 28,000 ppm.

and maximum salinities in the Intracoastal Waterway ranged from 6500 to 12,500 ppm.

51. The results of tests reproducing net westward flows in the Intracoastal Waterway (tests 7-9) are presented on plates 53-76 and in table 5. With a Calcasieu River discharge of 500 cfs and a net westward flow of 300 cfs in the Waterway (test 7), maximum salinities in the lower river ranged from 21,000 to 27,500 ppm, and maximum salinities in the Waterway ranged from 13,000 to 20,000 ppm. With a Calcasieu River discharge of 500 cfs and a net westward flow of 500 cfs in the Waterway (test 8), maximum salinities in the lower river ranged from 25,000 to 28,500 ppm, and in the Intracoastal Waterway maximum salinities ranged from 200 ppm at station 8 to 21,000 ppm at station 7. With a Calcasieu River discharge of 500 cfs and a net westward flow of 800 cfs in the Waterway (test 9), maximum salinities in the lower river ranged from 22,000 to 28,000 ppm, and maximum salinities in the Intracoastal Waterway ranged from 200 ppm at station 8 to 20,000 ppm at station 7.

Proposed (34-ft) Channel

52. Tests 10-18 and 21-25 were made with the proposed 34-ft channel installed in the model. Tests 10, 11, and 12 reproduced flow conditions identical to tests 1, 2, and 3; tests 13, 14, and 15 reproduced flow conditions identical to tests 4, 5, and 6; and tests 16, 17, and 18 reproduced flow conditions identical to tests 7, 8, and 9. As in tests 1-9, tests 10-18 were concerned with salinity intrusion in the lower Calcasieu River and the Calcasieu River-Mermentau River section of the Intracoastal Waterway. Tests 21-25 reproduced tidal flow only in the Intracoastal

Waterway and Calcasieu River discharges of 500 cfs, 1000 cfs, 2500 cfs, 5000 cfs, and 7500 cfs, respectively. These latter tests were concerned with salinity intrusion in the upper Calcasieu River, Houston River, and English Bayou.

53. The results of tests 10-18 are shown on plates 14-76, plotted against the results obtained with the existing channel installed in the model (tests 1-9), and in tables 3-5. During tests reproducing only tidal flow in the Intracoastal Waterway (tests 1-3 and 10-12), the channel deepening effected general increases in salinity at stations 1, 2, 3, and 6 in the Calcasieu River; however, in the Intracoastal Waterway at station 5 the difference in salinity for the two channel depths was negligible (see plates 14-31 and table 3). For a Calcasieu River discharge of 500 cfs, the salinity on the bottom at station 5 was greater than 20,000 ppm for both channel depths, indicating that water of high salinity would pass through the Waterway to the Mermentau River during low discharges in the Calcasieu River. River discharges of 5000 cfs and 7000 cfs lowered the elevation of the salt-water wedge in the river to such extent as to prevent density flow into and through the 9-ft-deep Intracoastal Waterway.

54. The results of tests reproducing net eastward flows in the Intracoastal Waterway (tests 4-6 and 13-15) indicate general increases in salinity due to the channel deepening at all stations in the lower Calcasieu River and in the Calcasieu River-Mermentau River section of the Intracoastal Waterway (see plates 32-52 and table 4). With a Calcasieu River discharge of 500 cfs, there was but little difference in salinity for the two channel depths. This condition was probably due to the fact that the elevation of the salt-water wedge was so near the surface for

the existing channel that further deepening of the channel could have but little effect on the elevation of the wedge. For all tests reproducing a net eastward flow of 1000 cfs in the Intracoastal Waterway, either with the existing or the proposed channel depth, the model results indicated that water of high salinity would pass through the Intracoastal Waterway to the Mermentau River.

55. The results of tests reproducing net westward flows in the Intracoastal Waterway (tests 7-9 and 16-18) indicate that the channel deepening would effect general increases in salinity at stations 1, 2, 3, and 6 in the Calcasieu River, and at stations 5 and 7 in the Calcasieu River-Mermentau River section of the Intracoastal Waterway (see plates 53-76 and table 5). However, net westward flows of 500 cfs or more were sufficient to hold the salt-water wedge west of station 8, even though salinities were increased at stations 5 and 7 by the channel deepening. It appears, therefore, that the channel deepening would not affect salinity conditions in the Mermentau River during times of net westward flows of 500 cfs or more in the Intracoastal Waterway.

56. The results of tests 21-25, which were concerned with salinity intrusion in the upper Calcasieu River, Houston River, and English Bayou, are shown on plates 77-86 and in table 6. The results of these tests indicate that with the proposed 34-ft channel installed, water of very high salinity would intrude upstream past stations 13 and 14, the uppermost stations at which salinity samples were obtained. With a river discharge of 7000 cfs, the salinity at station 14 in the Houston River was quite low; however, that at station 13 in the Calcasieu River reached a maximum of almost 27,000 ppm. For river discharges of 5000 cfs or less,

maximum salinities at all stations exceeded 26,000 ppm. As indicated on plates 77-86, periods of time ranging from 5 to 15 days (prototype) were required for the salt-water wedge to move from the Gulf to the vicinity of stations 13 and 14, the rate of progress of the wedge varying with the river discharge. Each test of this series (tests 21-25) was continued over a period of time equivalent to 40 days in the prototype.

Natural (1940) Channel

57. Tests 19, 20, 26, and 27 were made with the natural channel, which existed prior to dredging the 30-ft channel in 1940-41, installed in the model. Tests 19 and 20 were concerned with salinity intrusion in the lower Calcasieu River, while tests 26 and 27 were concerned with salinity intrusion in the upper Calcasieu River, Houston River, and English Bayou.

58. The results of tests 19 and 20 are shown in table 7, tabulated with comparable data obtained during tests 1 and 4 of the existing 30-ft channel. Flow conditions for tests 1 and 19, and for tests 4 and 20, were identical. The results of these tests indicate that dredging the existing ship channel in 1940-41 effected large increases in salinity throughout the lower Calcasieu River and in the Calcasieu River-Mermentau River section of the Intracoastal Waterway. Salinity samples obtained in the Intracoastal Waterway during tests 19 and 20 are not presented in table 7 since the values obtained were zero. Examination of the salinities measured at station 2, which was located in the Calcasieu River at its intersection with the Intracoastal Waterway, reveal that for test-19 conditions the salinity of the water at a depth of 18 ft was only 400 ppm,

while for test-20 conditions the salinity at a depth of 12 ft was only 800 ppm.

59. It is pointed out that tests 19 and 20 were discontinued after a period of 40 days (prototype); therefore, the salinity results presented for these tests do not represent the maximum which would have occurred had the tests been continued until the position of the salt-water wedge stabilized. In order to make the results of tests 19 and 20 directly comparable to those of tests 1 and 4 of the existing channel, the tests were continued for the same period of time as for tests 1 and 4. Therefore, comparison of the results of tests 19 and 20 with the results of tests 1 and 4 shows the effects of dredging the existing channel on the rate of salinity intrusion, but does not provide a direct comparison of maximum salinity conditions for the two channel depths.

60. The results of tests 26 and 27 are shown on plates 87-89 and in table 6. For test 26, bottom salinities at stations 13 and 14 reached a maximum of about 12,000 ppm after a period of operation equivalent to 180 days in the prototype. The period of time required for the salt-water wedge to intrude from the Gulf to the upper river ranged from 50 days at station 9 to 80 days at stations 13 and 14. For test 27, which reproduced a river discharge of 1000 cfs, no trace of salt water was found at station 10 or above after 180 days of operation. The maximum salinity found at station 9 for this test was only about 3000 ppm; moreover, there was no trace of salt water at this station at depths less than 24 ft.

PART V: DISCUSSION OF RESULTS

Effects of Proposed (34-ft) Channel

Lower Calcasieu River and Intracoastal Waterway

61. The results of comparable tests of the existing 30-ft channel and the proposed 34-ft channel indicate that deepening the channel to the latter depth would effect general increases in salinity throughout the lower Calcasieu River and the Calcasieu River-Mermentau River section of the Intracoastal Waterway. It is pointed out, however, that increases in salinities due to the channel deepening were, in most instances, limited to only a few hundred parts per million. Whether or not such increases would be detrimental to agricultural interests is beyond the scope of the model investigation.

62. The greatest increases in salinity in the Intracoastal Waterway resulting from the channel deepening occurred during tests reproducing net eastward flows in the Waterway. During the occurrence of such flows, however, salinities in the Waterway for the existing channel were very high; therefore, there appears to be some doubt that further increases in salinity, beyond those found for the existing channel, would be more detrimental to agricultural interests than would the already high salinities. In other words, if maximum salinities for existing conditions are so great (6,000 ppm to 22,000 ppm over the range of discharges tested) as to render the water unusable for irrigation purposes, then further increases of 3,000 ppm to 4,000 ppm appear to be of little significance.

63. One large increase in salinity which occurred at station 5 in the Intracoastal Waterway appears to be worthy of further consideration.

The maximum salinity at this station for test 9 of the existing channel was only 300 ppm, while the maximum salinity for test 18 of the proposed channel was 11,900 ppm. At first glance, therefore, it appears that the channel deepening effected a very large increase in salinity in the Intracoastal Waterway. Examination of comparable salinity measurements at stations 7 and 8, however, which were located in the Waterway to the west and to the east, respectively, from station 5, shows that salinities at those points were not changed appreciably by the channel deepening It may be concluded, therefore, that the large increase in salinity noted at station 5 was brought about by an eastward shift of the salt-water wedge in the Waterway, caused by slightly increased densities in the western end of the Waterway. Since the salinity at station 8 did not reflect the increase noted at station 5, it may be further concluded that the large increase in salinity was confined to a comparatively short length of the Intracoastal Waterway.

Upper Calcasieu River, Houston River, and English Bayou

64. Since salinity samples were not obtained in the upper Calcasieu River, Houston River, and English Bayou during tests of the existing 30-ft channel, it is not possible to make a direct comparison of salinities throughout that area for the two channel depths. It is pointed out, however, that the channel deepening caused a maximum increase of about 1000 ppm at stations 2 and 3 in the lower Calcasieu River, and it is considered probable that general increases of this nature would be found in the upper river also

65. It is also probable that the channel deepening would shift

upstream the upper limit of the salt-water wedge for any given river discharge. While the extent of such shift can not be determined from model salinity data, it appears reasonable to assume that, for a given river discharge, the salt-water wedge would intrude farther upstream for the 34-ft channel than for the existing 30-ft channel. It is doubtful, however, that an upstream shift in the location of the wedge would effect an appreciable increase in salinity near the surface, it being more likely that salinities at or near the bottom of the channel would show the greatest increase.

Effects of Existing (30-ft) Channel

Lower Calcasieu River and Intracoastal Waterway

66. The results of model tests indicate that dredging the existing 30-ft channel in 1940-41 effected large increases in salinity throughout the lower Calcasieu River and the Calcasieu River-Mermentau River section of the Intracoastal Waterway. Prior to the dredging of this channel, the shallow depths throughout Calcasieu Lake and Calcasieu Pass (controlling depth of about 5.5 ft) constituted a natural barrier to movement of salt water up the Calcasieu River. Density flow of salt water in any channel is controlled primarily by the salt-water head at the entrance. It is to be expected, therefore, that the rate and extent of salt-water intrusion into and through a 30-ft channel would be more serious than would occur in a channel having a controlling depth of less than 6.0 ft. Moreover, a given river discharge would be more effective in combatting salinity intrusion in the shallow channel than in the comparatively deep channel.

67. Attention is invited to the fact that a 30-ft-deep channel

from Calcasieu River to the Gulf, via the Lake Charles Deepwater Channel and the Sabine River, existed prior to dredging of the Calcasieu Lake and Calcasieu Pass channel in 1940-41. It is therefore possible that salinity conditions in the Calcasieu River and the Calcasieu River-Mermentau River section of the Intracoastal Waterway may have been affected to some extent by intrusion of salt water through this channel prior to dredging the Calcasieu Lake channel. However, intermittent salinity samples obtained in the Lake Charles Deepwater Channel during the 3-year period prior to dredging the Calcasieu Lake channel indicate a maximum salinity of about 9,500 ppm chlorides, whereas samples at the same point immediately following completion of the Calcasieu Lake channel indicate maximum salinities of about 19,000 ppm chlorides. Furthermore, the maximum salinity of 9,500 ppm chlorides found in the Lake Charles Deepwater Channel prior to dredging the Calcasieu Lake channel occurred at a time when salinities in Calcasieu Lake were very high and, while the field data are not conclusive in this respect, it appears that an increase in salinity in the north end of Calcasieu Lake preceded the increase in the Lake Charles Deepwater Channel, indicating that the source of intrusion into the Lake Charles Deepwater Channel was Calcasieu Lake rather than the Sabine River It is believed, therefore, that salinity intrusion into the Calcasieu River via the Lake Charles Deepwater Channel and the Sabine River is very minor as compared to intrusion via the Calcasieu Lake and Calcasieu Pass channel.

Upper Calcasieu River, Houston River, and English Bayou

68. As stated previously, no salinity data were obtained in the

upper Calcasieu River, Houston River, and English Bayou during tests of the existing 30-ft channel. However, based upon the differences in salinity found throughout that area during tests of the natural (1940) channel and of the proposed 34-ft channel, there appears to be little doubt that dredging the existing 30-ft channel effected large increases in both the rate of salinity intrusion and the maximum salinity which would obtain for a given river discharge.

69. With the natural channel installed in the model, and reproducing a river discharge of only 500 cfs, periods of time ranging from 60 to 80 days (prototype) were required for the salt-water wedge to intrude from the Gulf of Mexico into the upper river. Moreover, after a period of operation equivalent to 180 days in the prototype, water having a sufficiently low salinity to be usable for irrigation purposes could be obtained from near the surface.

70. Increasing the river discharge to 1000 cfs prevented the intrusion of salt water past station 9, even after a period of time equivalent to 180 days in the prototype. The tests were discontinued after 180 days of operation due to the improbability that sustained low flows of 500 cfs to 1000 cfs over such a period of time would occur in nature.

PART VI: CONCLUSIONS

71. The principal conclusions drawn from an analysis of the results of all model tests follow:

a. Deepening the Calcasieu River Ship Channel from the present project depth of 30 ft to the proposed 34-ft depth would have no noteworthy effect on salinity intrusion in the lower Calcasieu River or in the Calcasieu River-Mermentau River section of the Intracoastal Waterway during periods of net westward flow, or reversing tidal flow, in the Waterway. During periods of net eastward flow in the Waterway, the proposed deepening would effect general increases in salinity at stations in the Waterway. It is pointed out, however, that net eastward flows in the Waterway occur very infrequently in the prototype, and during such flows the salinity of the water passing through the Waterway would be higher than that acceptable for irrigation purposes, either with the 30-ft or the 34-ft channel.

b. Dredging of the existing 30-ft channel in 1940-1941 caused large increases in salinity throughout the lower Calcasieu River, the upper Calcasieu River, and in the Calcasieu River-Mermentau River section of the Intracoastal Waterway.

c. Although salinity samples were not obtained in the upper Calcasieu River with the existing 30-ft channel installed in the model, it is believed that deepening the channel to 34 ft would have but little effect on salinity intrusion in the upper Calcasieu River. This opinion is based upon comparable salinity observations throughout the lower 28 miles of the river with the existing 30-ft channel and the proposed 34-ft channel installed in the model.

TABLES

Table 1

SALINITY MEASUREMENTS -- VERIFICATION TEST

Salinity values are expressed in parts per million
and represent average of all samples obtained during one tidal cycle

Salinity Station	Depth Sample Taken	Average Salinity for one Tidal Cycle	
		Model	Prototype
1	0.0	2,360	3,280
1	-15.0	5,625	5,290
1	-30.0	14,790	12,670
2	0.0	500	430
2	-14.0	500	430
2	-28.0	12,340	9,740
3	0.0	400	330
3	-16.0	500	418
3	-31.0	14,520	7,150
4	0.0	75	73
4	-15.0	80	74
4	-30.0	85	76
5	0.0	400	320
5	-6.0	400	319
5	-12.0	400	322
6	0.0	700	657
6	-14.0	700	669
6	-27.0	2,000	1,968

Table 2

FLOW CONDITIONS

Test No.	Intracoastal Waterway Direction of Flow:	Net Flow:	Discharge in Calcasieu River:	Depth of Channel
1	----	Tidal	500 cfs	30 ft
2	----	"	5000 cfs	"
3	----	"	7000 cfs	"
4	E	1000 cfs	500 cfs	"
5	E	"	5000 cfs	"
6	E	"	7000 cfs	"
7	W	300 cfs	500 cfs	"
8	W	500 cfs	500 cfs	"
9	W	800 cfs	500 cfs	"
10	----	Tidal	500 cfs	34 ft
11	----	"	5000 cfs	"
12	----	"	7000 cfs	"
13	E	1000 cfs	500 cfs	"
14	E	"	5000 cfs	"
15	E	"	7000 cfs	"
16	W	300 cfs	500 cfs	"
17	W	500 cfs	500 cfs	"
18	W	800 cfs	500 cfs	"
19	----	Tidal	500 cfs	1940 Channel
20	E	1000 cfs	500 cfs	"
21	----	Tidal	500 cfs	34 ft
22	----	"	1000 cfs	"
23	----	"	2500 cfs	"
24	----	"	5000 cfs	"
25	----	"	7500 cfs	1940 Channel
26	----	"	500 cfs	"
27	----	"	1000 cfs	"

Table 3

RESULTS OF SALINITY TESTS 1, 2, 3, 10, 11, AND 12

Tidal Flow in Intracoastal Waterway

Salinity values are expressed in parts per million
and represent average of all samples taken at indicated station and depth

Salinity Station	Depth Sample Taken	Calcasieu River Discharge								
		500 cfs			5,000 cfs			7,000 cfs		
		Test 1 Existing Channel	Test 10 Proposed Channel	Increase or Decrease in Parts per Million	Test 2 Existing Channel	Test 11 Proposed Channel	Increase or Decrease in Parts per Million	Test 3 Existing Channel	Test 12 Proposed Channel	Increase or Decrease in Parts per Million
1	0.0	18,000	18,500	+ 500	10,100	11,300	+ 1,200	8,000	8,400	+ 400
1	- 15.0	19,300	19,700	+ 400	11,300	12,900	+ 1,600	9,700	9,700	0
1	- 30.0	23,600	24,900	+ 1,300	19,500	20,200	+ 700	18,700	19,700	+ 1,000
2	0.0	1,500	1,600	+ 100	1,100	1,000	- 100	700	800	+ 100
2	- 6.0	18,000	19,100	+ 1,100	1,200	1,100	- 100	900	1,000	+ 100
2	- 12.0	22,200	22,400	+ 200	16,000	16,000	0	5,200	6,400	+ 1,200
2	- 18.0	23,400	23,500	+ 100	17,600	18,100	+ 500	15,800	15,600	- 200
2	- 24.0	24,600	23,600	- 1,000	23,100	22,100	- 1,000	21,200	20,300	- 900
2	- 28.0	25,300	24,600	- 700	23,900	22,900	- 1,000	22,000	21,100	- 900
3	0.0	1,200	1,300	+ 100	600	600	0	400	400	0
3	- 16.0	23,700	23,700	0	2,600	3,400	+ 800	1,000	1,100	+ 100
3	- 31.0	24,100	24,400	+ 300	20,400	21,900	+ 1,500	20,000	21,000	+ 1,000
5	0.0	400	600	+ 200	200	200	0	200	200	0
5	- 6.0	2,800	2,500	- 300	400	300	- 100	400	400	0
5	- 12.0	21,300	20,700	- 600	700	700	0	900	700	- 200
6	0.0	3,400	3,500	+ 100	1,200	1,500	+ 300	1,000	1,100	+ 100
6	- 14.0	21,600	24,900	+ 3,300	12,600	13,900	+ 1,300	4,400	6,400	+ 2,000
6	- 27.0	24,600	25,500	+ 900	20,900	20,800	- 100	18,400	19,600	+ 1,200
7	0.0	---	---	---	---	---	---	700	700	0
7	- 6.0	---	---	---	---	---	---	700	800	+ 100
7	- 12.0	---	---	---	---	---	---	800	900	+ 100

NOTE: Existing channel has project depth of - 30 ft, Gulf mlw, and an actual controlling depth of - 27 ft, Gulf mlw
Proposed channel in model constructed to project depth of - 34 ft, Gulf mlw

Table 4

RESULTS OF SALINITY TESTS 4, 5, 6, 13, 14, AND 15

Net Eastward Flow of 1,000 cfs in Intracoastal Waterway

Salinity values are expressed in parts per million
and represent average of all samples taken at indicated station and depth

Salinity Station	Depth Sample Taken	Calcasieu River Discharge								
		500 cfs			5,000 cfs			7,000 cfs		
		Test 4 Existing Channel	Test 13 Proposed Channel	Increase or Decrease in Parts per Million	Test 5 Existing Channel	Test 14 Proposed Channel	Increase or Decrease in Parts per Million	Test 6 Existing Channel	Test 15 Proposed Channel	Increase or Decrease in Parts per Million
1	0.0	19,100	19,800	+ 700	10,000	11,900	+ 1,100	8,200	9,400	+ 1,200
1	- 15.0	19,700	20,300	+ 600	12,200	13,700	+ 1,500	9,800	10,900	+ 1,100
1	- 30.0	24,600	24,600	0	19,800	21,700	+ 1,900	19,100	19,700	+ 600
2	0.0	1,400	2,100	+ 700	1,400	1,300	- 100	1,200	1,000	- 200
2	- 6.0	19,000	19,200	+ 200	1,600	4,600	+ 3,000	1,300	1,100	- 200
2	- 12.0	22,700	22,600	- 100	16,400	16,700	+ 300	12,200	14,100	+ 1,900
2	- 18.0	23,000	23,900	+ 900	17,800	18,400	+ 600	15,700	17,400	+ 1,700
2	- 24.0	23,600	24,700	+ 1,100	21,800	21,500	- 300	21,600	21,500	- 100
2	- 28.0	24,700	25,000	+ 300	23,400	22,500	- 900	22,600	21,500	- 1,100
3	0.0	1,500	2,900	+ 1,400	1,100	1,300	+ 200	800	1,000	+ 200
3	- 16.0	22,600	22,200	- 400	6,000	8,600	+ 2,600	1,300	1,100	- 200
3	- 31.0	23,700	23,000	- 700	22,100	21,300	- 800	20,100	20,800	+ 700
5	0.0	2,100	2,400	+ 300	1,500	1,700	+ 200	1,400	1,700	+ 300
5	- 6.0	11,500	11,500	0	2,000	1,900	- 100	1,600	1,600	0
5	- 12.0	21,900	21,400	- 500	11,800	14,800	+ 3,000	6,100	9,700	+ 3,600
6	0.0	6,000	5,100	- 900	2,000	1,600	- 400	1,500	1,700	+ 200
6	- 14.0	22,400	21,300	- 1,100	12,400	16,100	+ 3,700	9,500	9,900	+ 400
6	- 27.0	24,700	22,100	- 2,600	18,200	19,400	+ 1,200	19,700	19,700	0
7	0.0	2,300	2,500	+ 200	1,500	1,500	0	1,300	1,400	+ 100
7	- 6.0	13,500	15,900	+ 2,400	1,900	2,300	+ 400	1,600	2,000	+ 400
7	- 12.0	22,100	22,200	+ 100	14,700	15,800	+ 1,100	11,100	12,100	+ 1,000

NOTE: Existing channel has project depth of - 30 ft, Gulf mlw, and an actual controlling depth of - 27 ft, Gulf mlw
Proposed channel in model constructed to project depth of - 34 ft, Gulf mlw

Table 5

RESULTS OF SALINITY TESTS 7, 8, 9, 16, 17, AND 18

Calcasieu River Discharge 500 cfs

Salinity values are expressed in parts per million
and represent average of all samples taken at indicated station and depth

Salinity Station	Depth Sample Taken	Net Westward Flow in Intracoastal Waterway								
		300 cfs			500 cfs			800 cfs		
		Test 7 Existing Channel	Test 16 Proposed Channel	Increase or Decrease in Parts per Million	Test 8 Existing Channel	Test 17 Proposed Channel	Increase or Decrease in Parts per Million	Test 9 Existing Channel	Test 18 Proposed Channel	Increase or Decrease in Parts per Million
1	0.0	16,700	18,500	+ 1,800	16,600	17,800	+ 1,200	14,700	16,400	+ 1,700
1	- 15.0	17,500	19,400	+ 1,900	17,700	19,100	+ 1,400	16,000	17,500	+ 1,500
1	- 30.0	21,300	23,100	+ 1,800	22,200	23,400	+ 1,200	21,600	22,900	+ 1,300
2	0.0	1,600	1,700	+ 100	1,200	1,400	+ 200	900	900	0
2	- 6.0	18,500	18,800	+ 300	18,700	19,100	+ 400	12,200	16,700	+ 4,500
2	- 12.0	20,500	21,800	+ 1,300	20,500	21,900	+ 1,400	20,300	20,600	+ 300
2	- 18.0	21,300	23,100	+ 1,800	21,700	22,800	+ 1,100	21,200	21,600	+ 400
2	- 24.0	21,500	23,900	+ 2,400	23,500	23,400	- 100	23,300	22,600	- 700
2	- 28.0	22,500	24,200	+ 1,700	24,700	23,400	- 1,300	24,600	22,800	- 1,800
3	0.0	2,100	3,600	+ 1,500	1,300	1,400	+ 100	1,200	1,100	- 100
3	- 16.0	20,300	22,100	+ 1,800	22,100	22,200	+ 100	19,400	21,300	+ 1,900
3	- 31.0	20,600	22,900	+ 2,300	24,300	22,400	- 1,900	20,800	22,000	+ 1,200
5	0.0	600	400	- 200	200	200	0	200	200	0
5	- 6.0	1,500	1,900	+ 400	600	600	0	200	400	+ 200
5	- 12.0	19,500	19,900	+ 400	19,500	19,900	+ 400	300	11,900	+ 11,600
6	0.0	5,000	6,200	+ 1,200	5,400	5,900	+ 500	1,900	1,500	- 400
6	- 14.0	20,200	21,500	+ 1,300	21,900	21,900	0	19,700	19,900	+ 200
6	- 27.0	21,000	22,000	+ 1,000	23,800	22,200	- 1,600	22,200	22,000	- 200
7	0.0	500	900	+ 400	300	300	0	400	200	- 200
7	- 6.0	6,300	7,200	+ 900	5,300	2,600	- 2,700	600	2,600	+ 2,000
7	- 12.0	19,700	21,900	+ 2,200	20,100	21,100	+ 1,000	15,200	18,200	+ 3,000
8	0.0	300	300	0	200	100	- 100	200	100	- 100
8	- 6.0	700	500	- 200	200	100	- 100	200	100	- 100
8	- 12.0	11,900	14,500	+ 2,600	200	200	0	200	200	0

NOTE: Existing channel has project depth of - 30 ft, Gulf mlw, and an actual controlling depth of - 27 ft, Gulf mlw
Proposed channel in model constructed to project depth of - 34 ft, Gulf mlw

Table 6

RESULTS OF SALINITY TESTS OF UPPER CALCASIEU RIVER

Salinity values are expressed in parts per million

Salinity Station	Depth Sample Taken	Tests of 1940 Channel		Tests of 34-foot Channel				
		Duration of Tests--180 Days		Duration of Tests--40 Days				
		Test 26 Discharge-500 cfs	Test 27 Discharge-1,000 cfs	Test 21 Discharge-500 cfs	Test 22 Discharge-1,000 cfs	Test 23 Discharge-2,500 cfs	Test 24 Discharge-5,000 cfs	Test 25 Discharge-7,500 cfs
9	0.0	1,400	200	3,300	4,000	2,500	1,400	1,400
9	- 8.0	8,000	200	20,000	17,000	7,900	1,400	1,100
9	- 16.0	11,900	200	27,700	26,500	26,400	25,800	3,600
9	- 24.0	13,900	600	28,000	27,800	26,900	27,200	25,900
9	- 32.0	14,400	3,200	27,800	27,700	27,700	27,400	26,900
10	0.0	2,100	200	5,300	4,600	1,500	1,500	900
10	- 7.0	7,400	200	16,400	10,100	3,000	1,300	800
10	- 14.0	11,300	200	26,800	25,900	25,200	7,500	1,100
10	- 21.0	12,900	200	27,800	26,900	27,500	25,700	25,100
10	- 28.0	13,800	200	28,200	27,500	27,500	27,000	26,400
11	0.0	2,600	200	6,900	4,600	1,400	1,400	800
11	- 9.0	8,800	200	21,200	10,300	2,100	1,400	700
11	- 18.0	11,100	200	28,000	26,100	27,500	22,600	1,000
11	- 27.0	12,900	200	28,000	28,100	27,700	26,900	25,700
11	- 36.0	13,500	200	28,000	28,000	28,100	27,800	26,500
12	0.0	1,400	200	5,400	2,800	1,400	1,100	600
12	- 15.0	10,800	200	26,800	26,900	26,700	1,900	700
12	- 30.0	12,600	200	27,600	27,300	27,700	26,700	25,700
12	- 45.0	13,100	200	28,000	28,000	28,300	27,000	26,600
12	- 60.0	13,600	200	28,300	27,700	27,700	27,600	26,600
13	0.0	1,100	200	2,600	2,500	900	1,300	500
13	- 6.0	3,900	200	12,700	6,500	3,000	1,100	500
13	- 12.0	8,000	200	26,400	23,500	14,000	1,200	600
13	- 18.0	11,500	200	28,200	27,500	26,700	18,000	900
13	- 24.0	12,300	200	28,200	26,900	27,300	26,800	6,500
14	0.0	3,200	200	8,800	4,900	900	900	500
14	- 8.0	4,200	200	11,500	5,000	1,700	1,000	500
14	- 16.0	11,100	200	27,000	26,600	26,200	800	700
14	- 24.0	12,000	200	27,400	27,800	28,000	19,900	800
14	- 32.0	12,500	200	28,100	27,000	27,500	26,900	600

NOTE: Salinity values represent maximum obtained regardless of length of test and were not necessarily obtained at end of test.

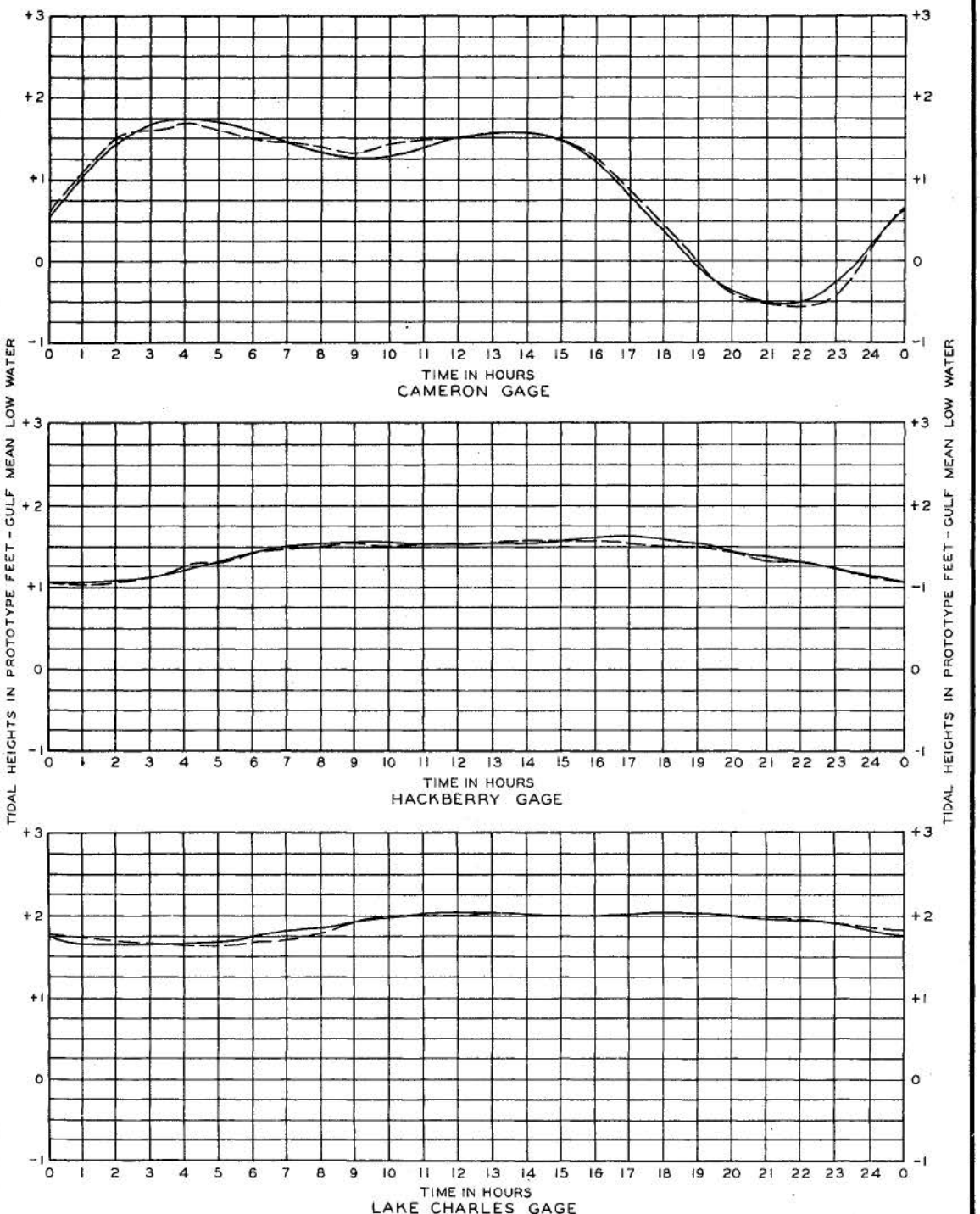
Table 7

RESULTS OF SALINITY TESTS OF NATURAL (1940) CHANNEL

Salinity values are expressed in parts per million
and represent average of all samples taken at indicated station and depth

Salinity Station	Depth Sample Taken	Calcasieu River Discharge 500 cfs Tidal Flow in Intracoastal Waterway		Calcasieu River Discharge 500 cfs 1,000 cfs East Flow in Intracoastal Waterway	
		1940 Channel (Test 19)	Existing Channel (Test 1)	1940 Channel (Test 20)	Existing Channel (Test 4)
1	Top	9,500	18,000	11,600	19,100
1	Mid-depth	10,400	19,300	11,500	19,700
1	Bottom	9,600	23,600	11,500	24,600
2	0.0	100	1,500	200	1,400
2	-6.0	100	18,000	200	19,000
2	-12.0	300	22,200	800	22,700
2	-18.0	400	23,400	1,500	23,000
2	-24.0	4,100	24,600	6,000	24,700
2	-28.0	5,500	25,300	6,300	24,700
3	Top	---	---	200	1,500
3	Mid-depth	---	---	300	22,600
3	Bottom	---	---	3,600	23,700

PLATES



LEGEND

——— PROTOTYPE TIDAL HEIGHTS

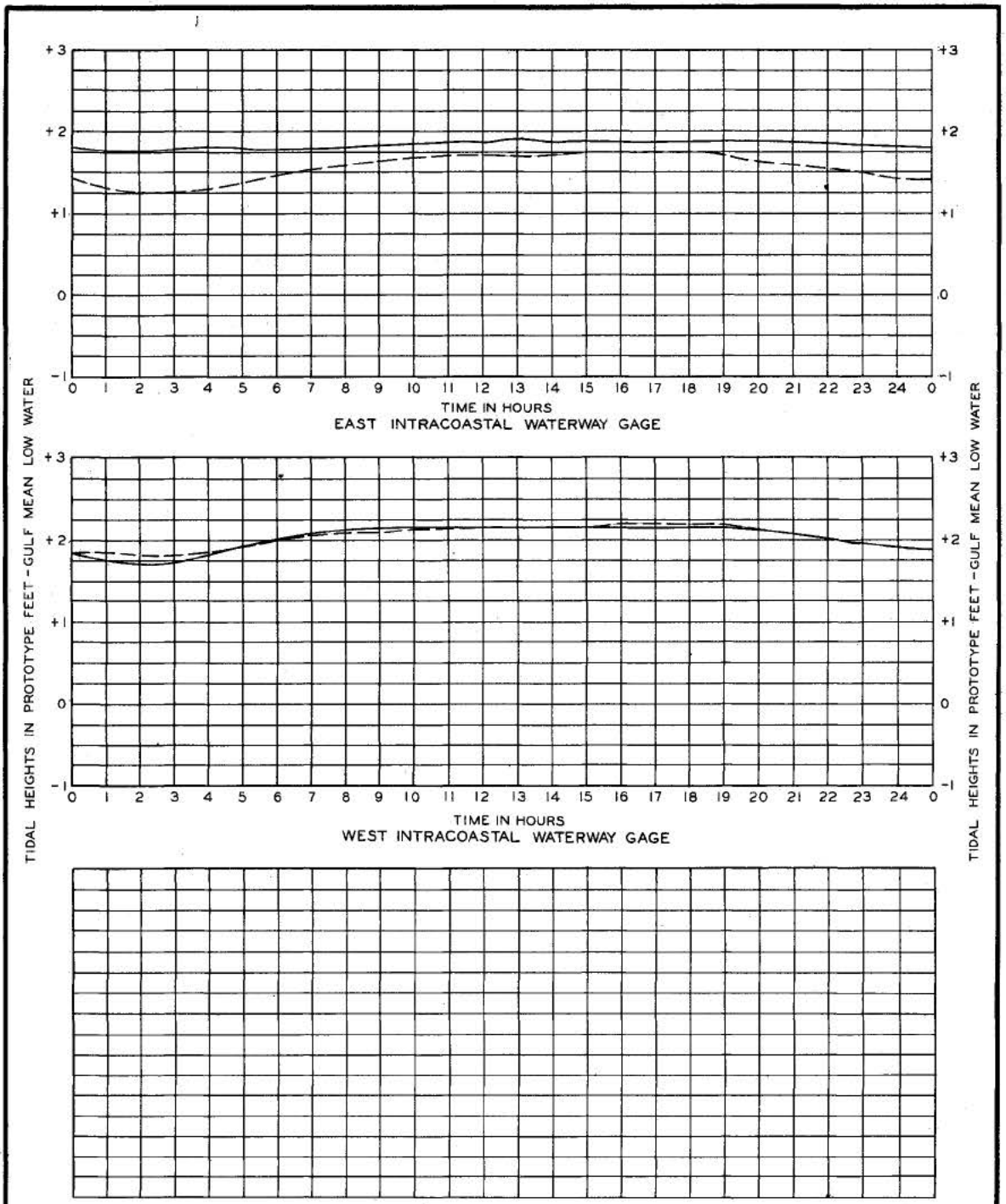
– – – – MODEL TIDAL HEIGHTS

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

MODEL REPRODUCTION OF PROTOTYPE TIDAL HEIGHTS

SPRING TIDE RIVER DISCHARGE 11,000 CFS

PLATE 1



LEGEND

———— PROTOTYPE TIDAL HEIGHTS

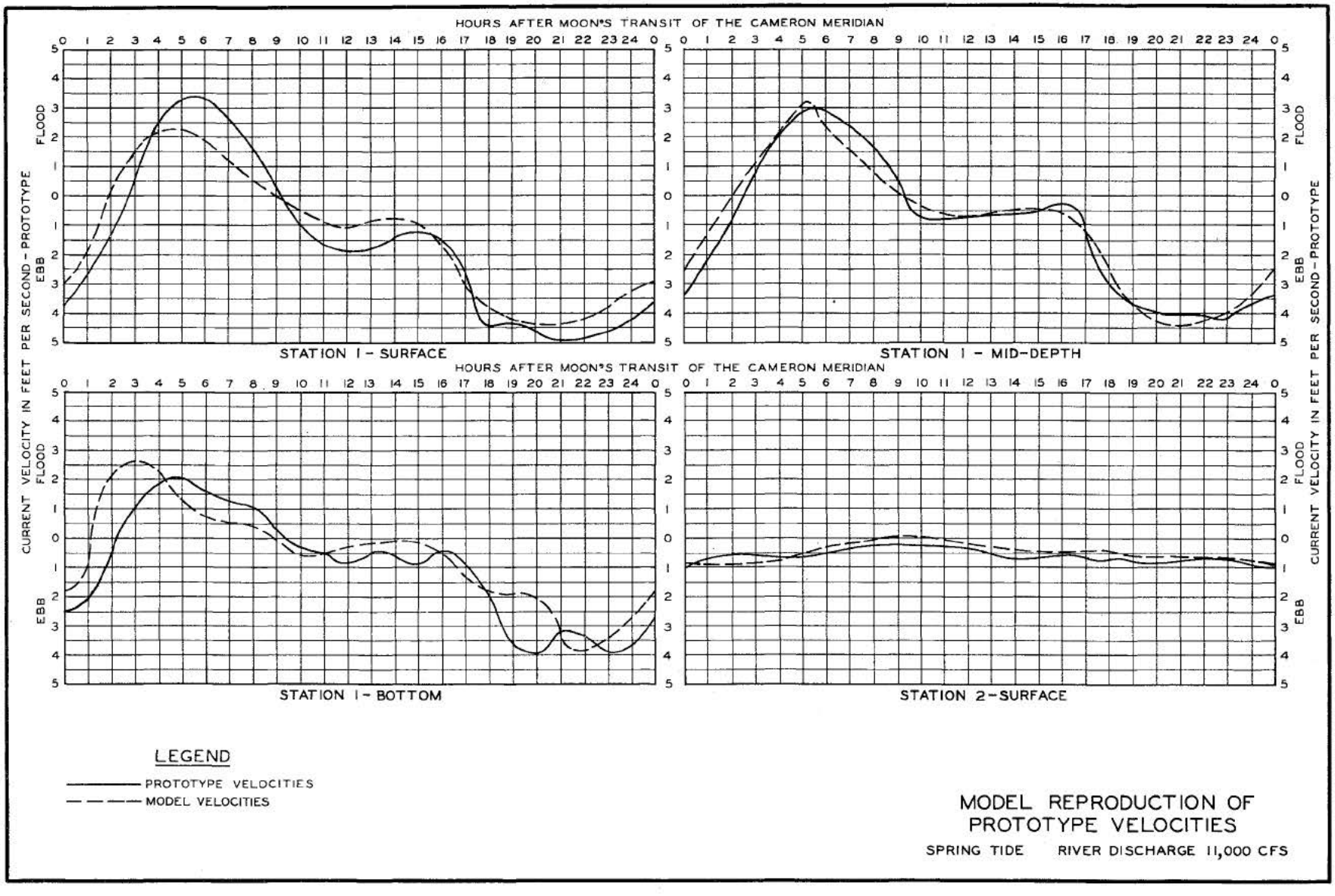
— — — — MODEL TIDAL HEIGHTS

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

MODEL REPRODUCTION OF PROTOTYPE TIDAL HEIGHTS

SPRING TIDE RIVER DISCHARGE 11,000 CFS

PLATE 2

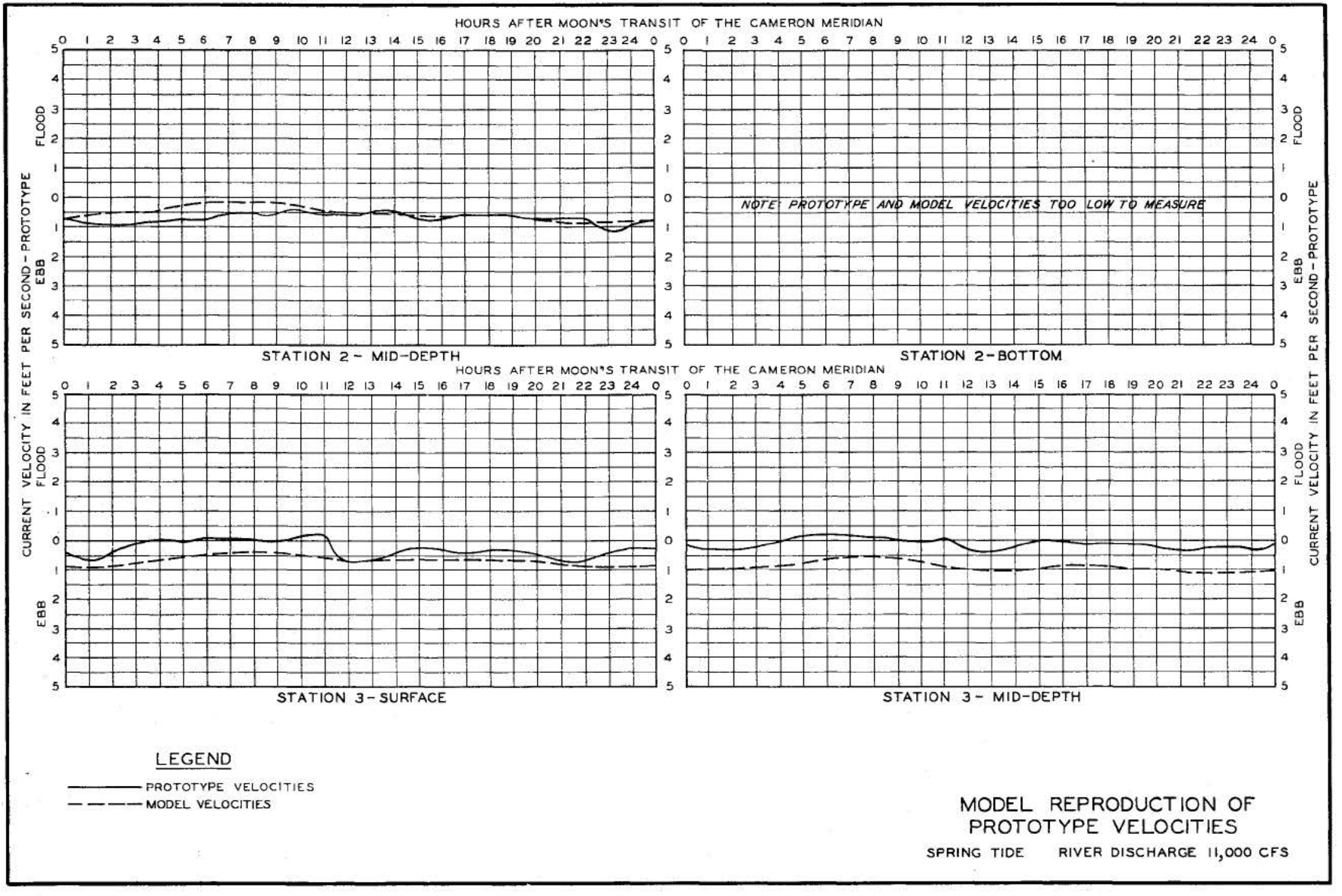


MODEL REPRODUCTION OF PROTOTYPE VELOCITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

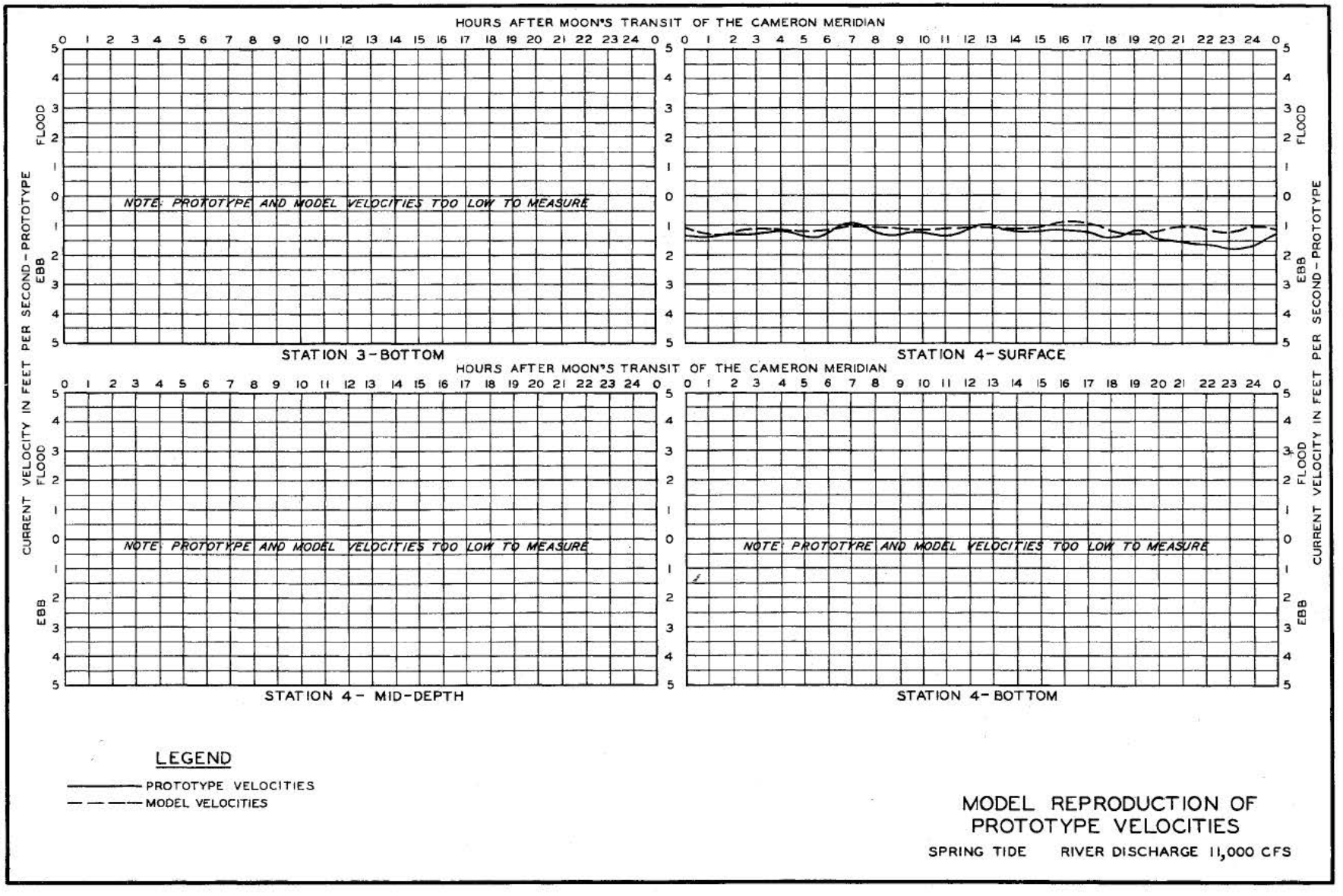
PLATE 3

PLATE 4



MODEL REPRODUCTION OF PROTOTYPE VELOCITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

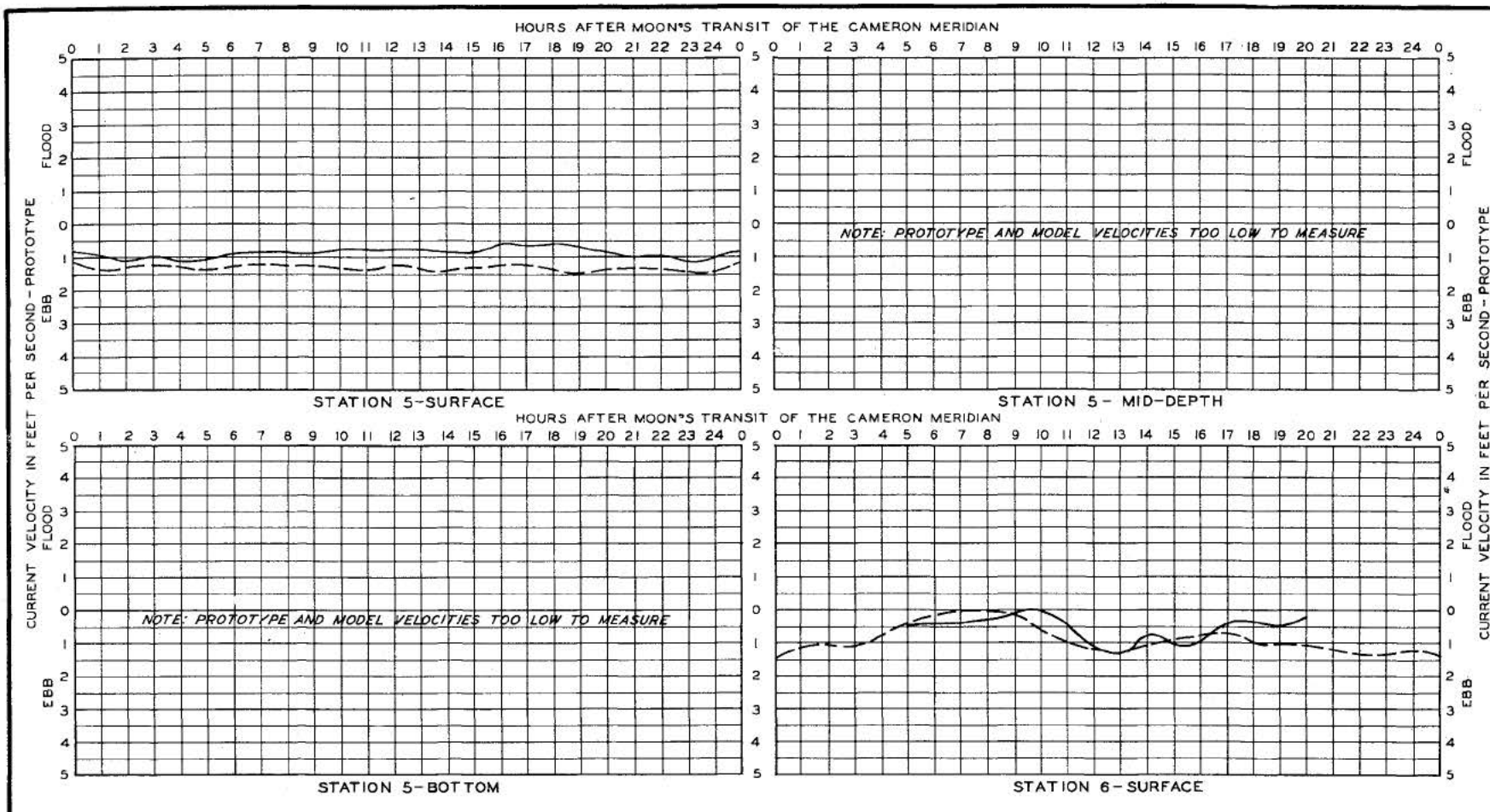


MODEL REPRODUCTION OF PROTOTYPE VELOCITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

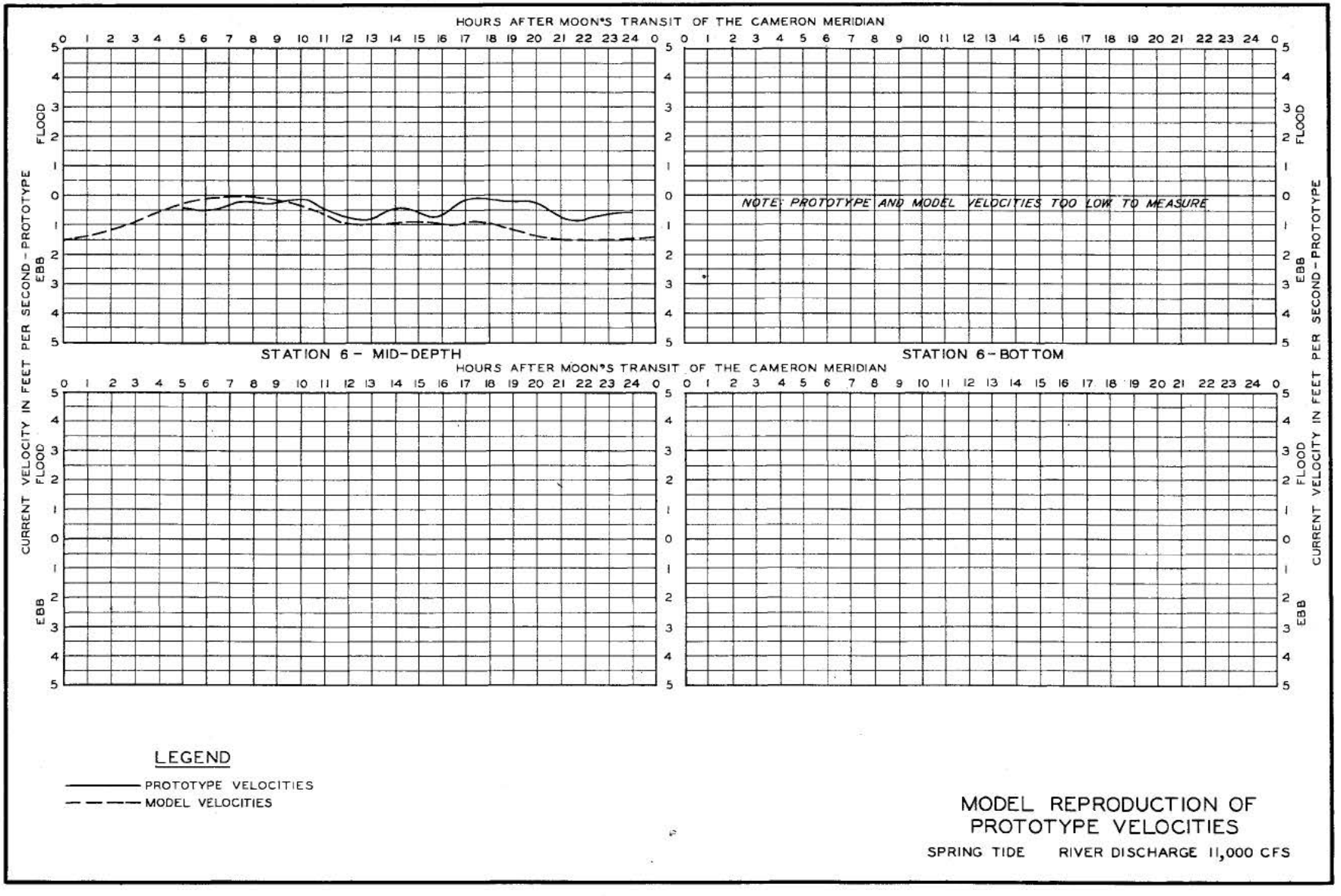
PLATE 5

PLATE 6



MODEL REPRODUCTION OF PROTOTYPE VELOCITIES

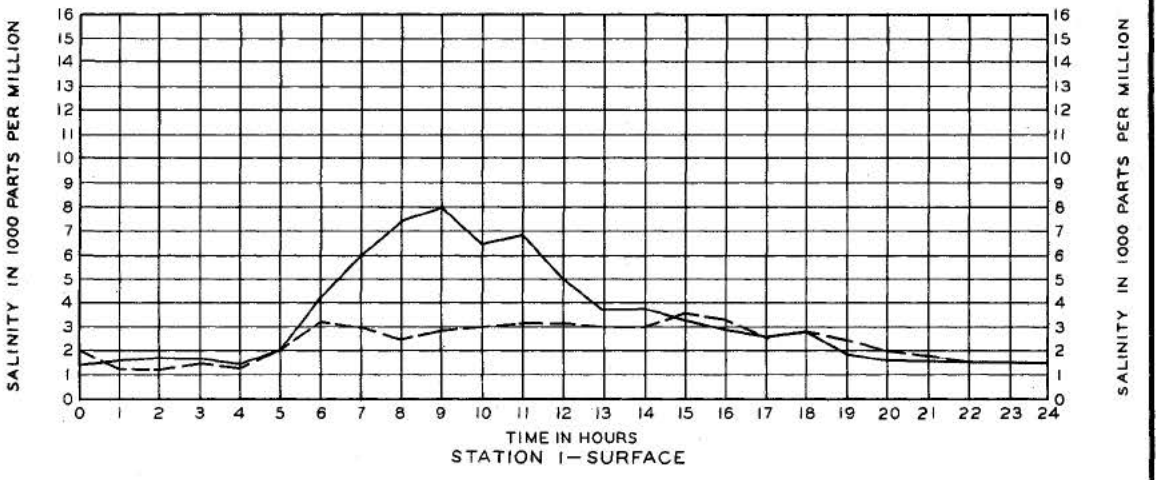
SPRING TIDE RIVER DISCHARGE 11,000 CFS

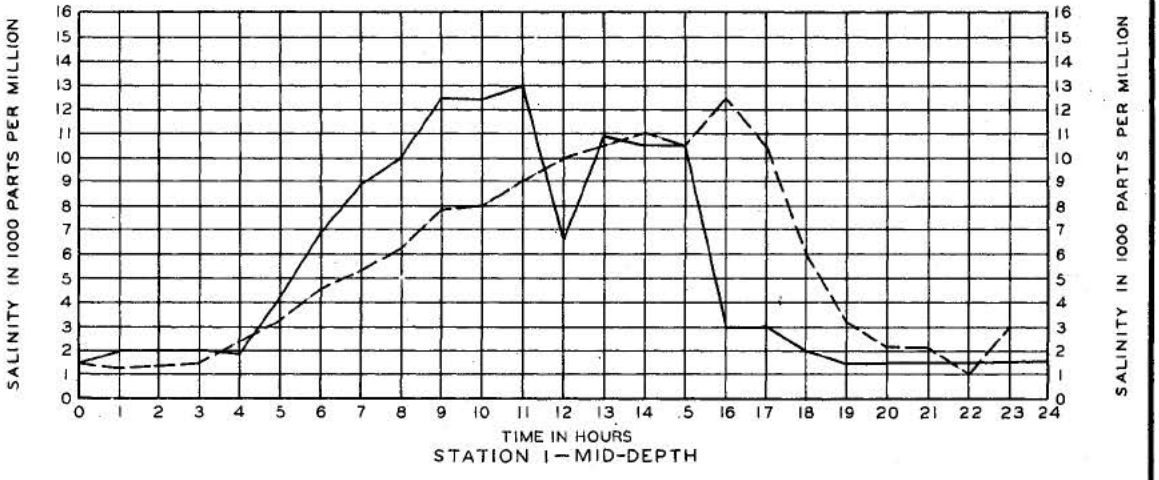


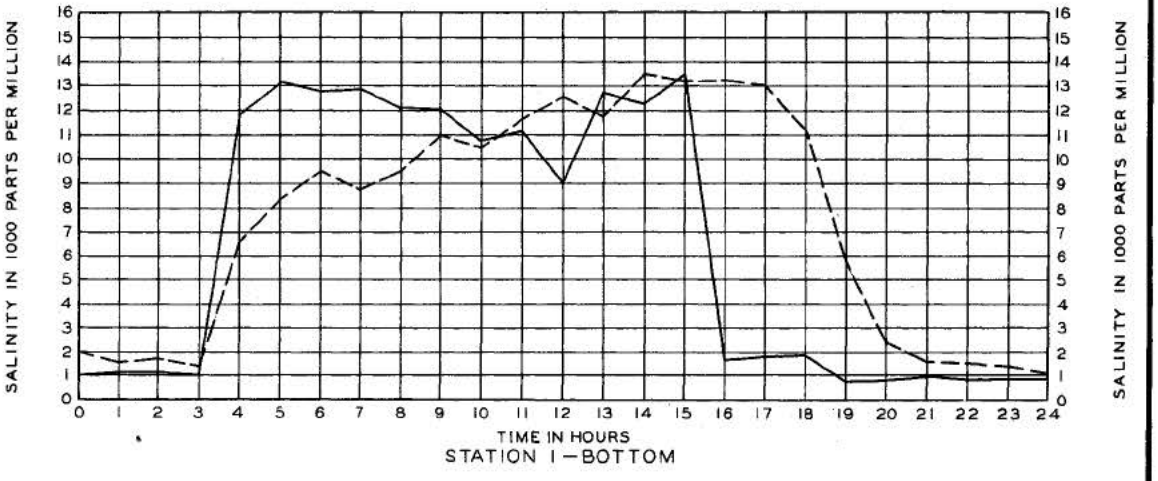
MODEL REPRODUCTION OF
PROTOTYPE VELOCITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

PLATE 7







LEGEND

———— PROTOTYPE SALINITIES

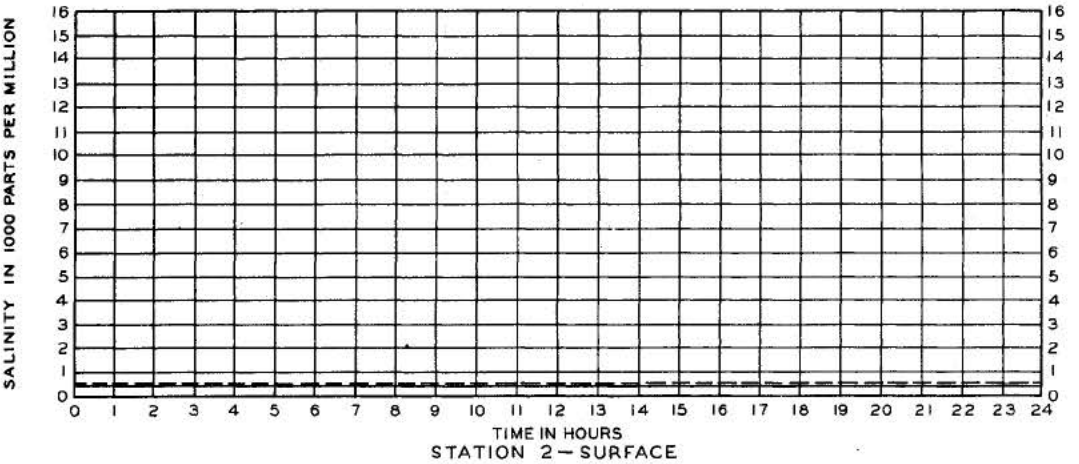
— — — — MODEL SALINITIES

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

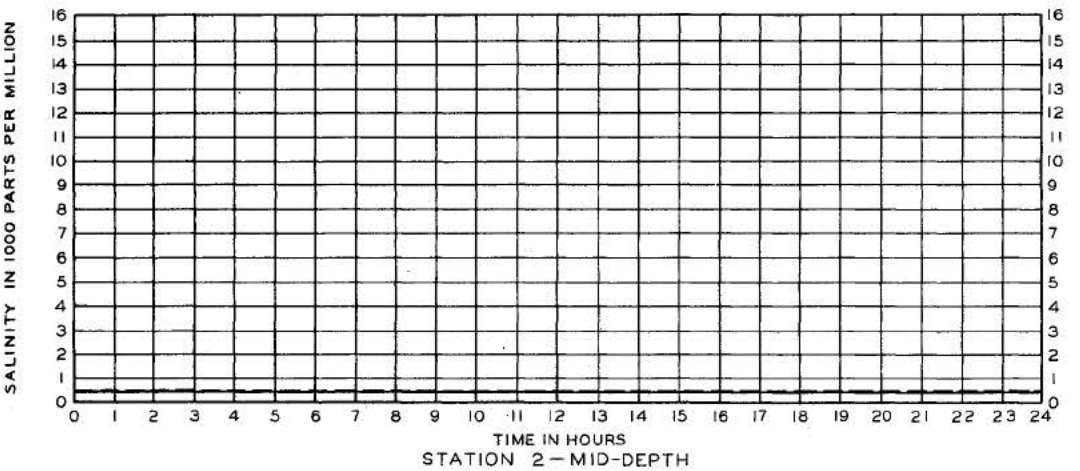
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

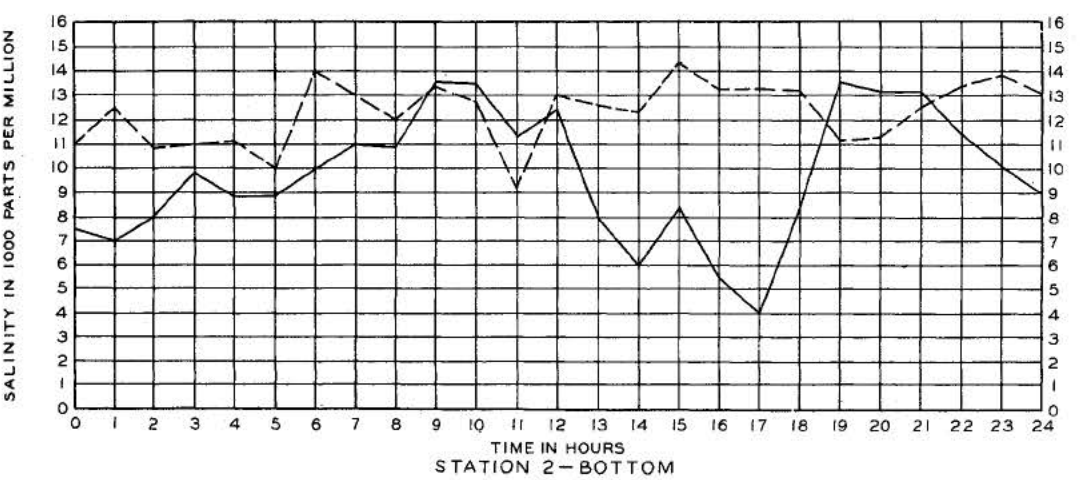
PLATE 8



STATION 2 – SURFACE



STATION 2 – MID-DEPTH



STATION 2 – BOTTOM

LEGEND

——— PROTOTYPE SALINITIES

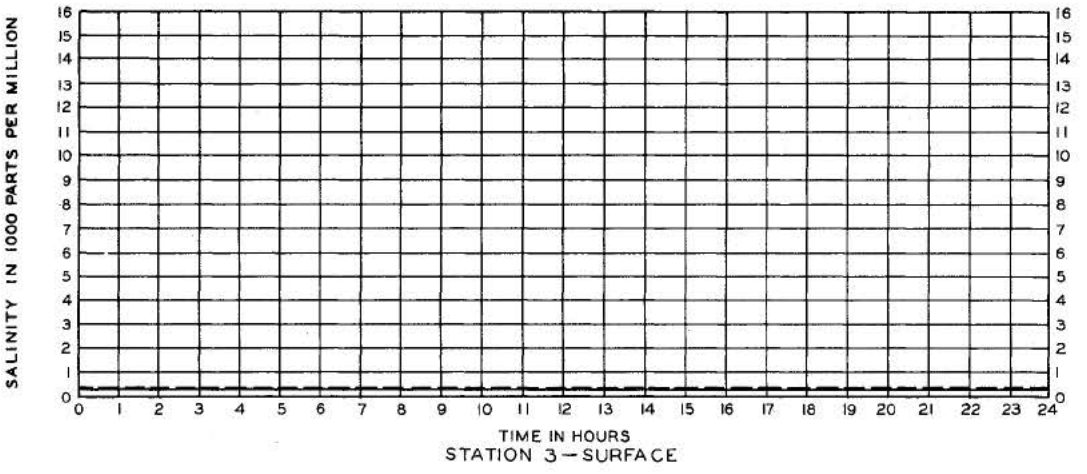
– – – – MODEL SALINITIES

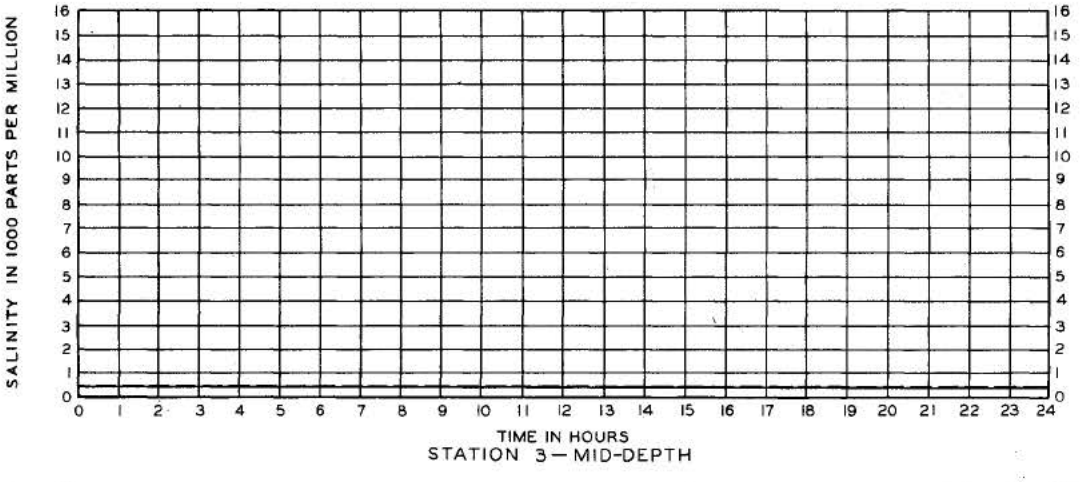
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

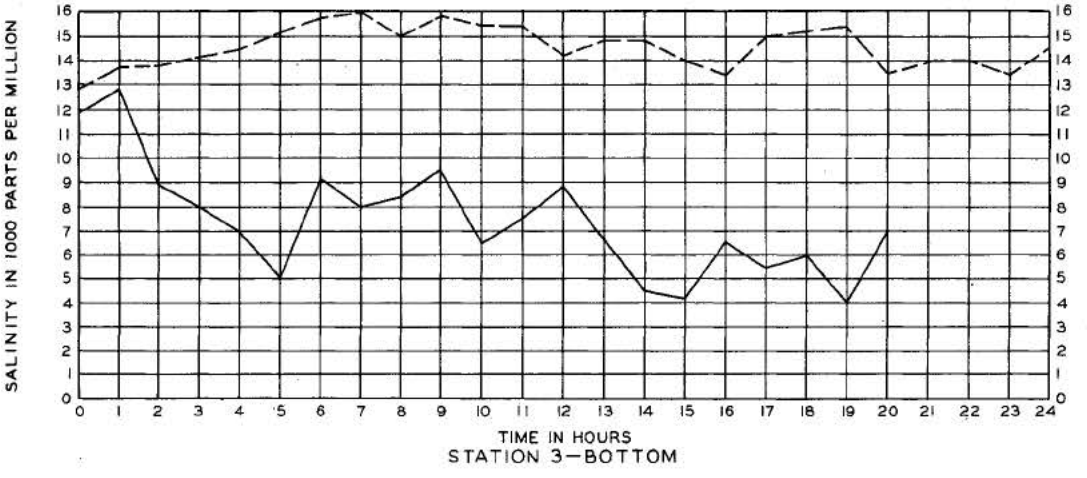
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

PLATE 9







LEGEND

——— PROTOTYPE SALINITIES

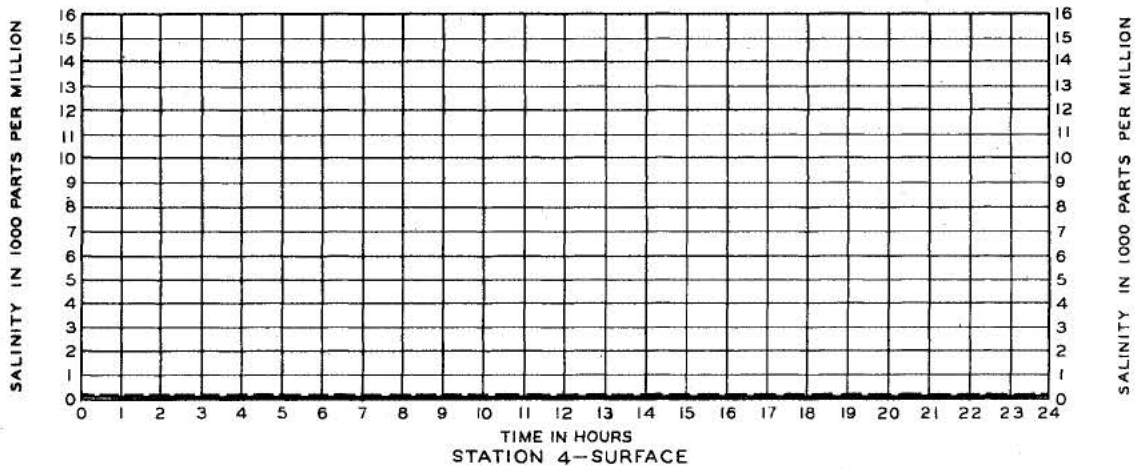
— — — — MODEL SALINITIES

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

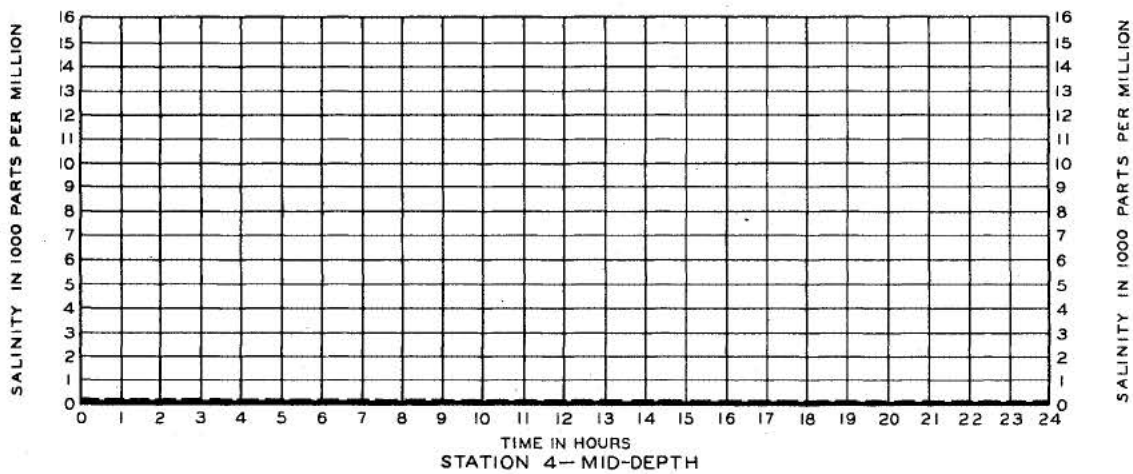
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

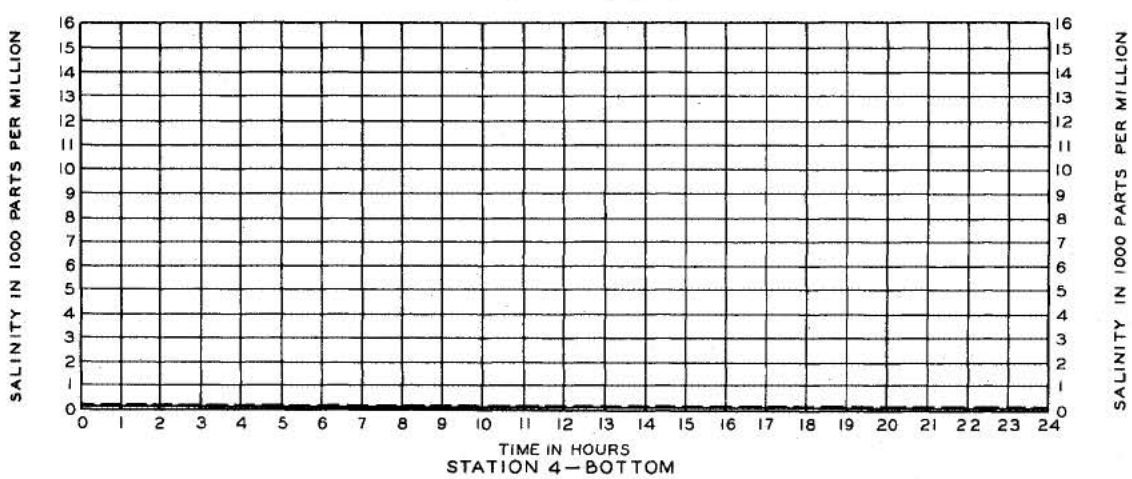
PLATE 10



STATION 4—SURFACE



STATION 4—MID-DEPTH



STATION 4—BOTTOM

LEGEND

———— PROTOTYPE SALINITIES

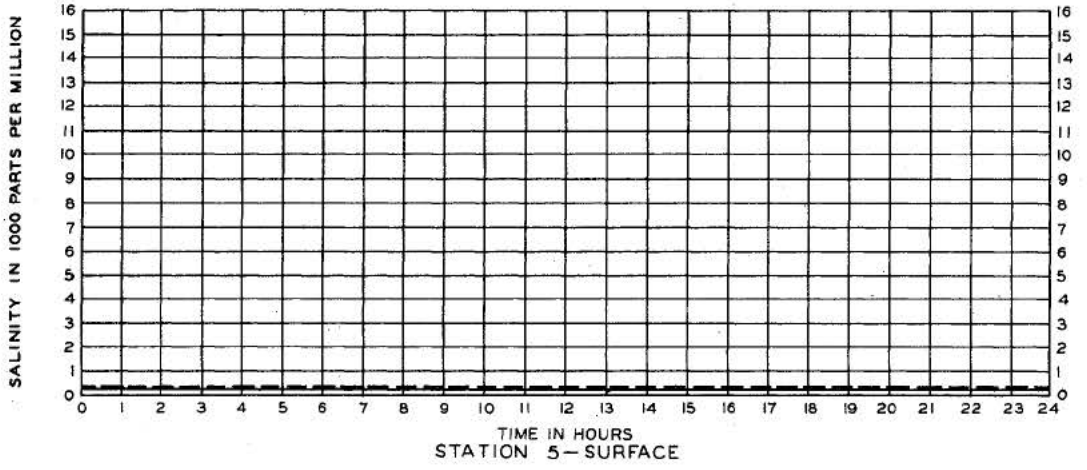
– – – – MODEL SALINITIES

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

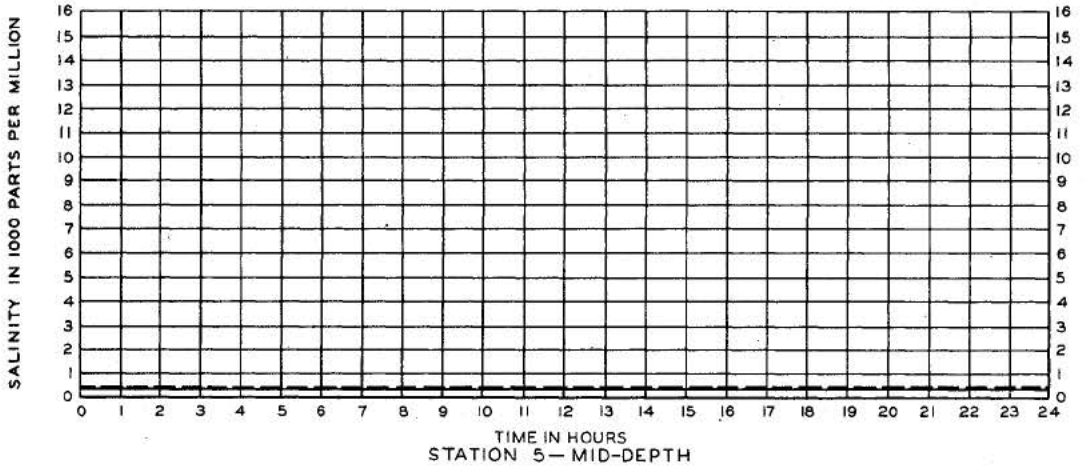
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

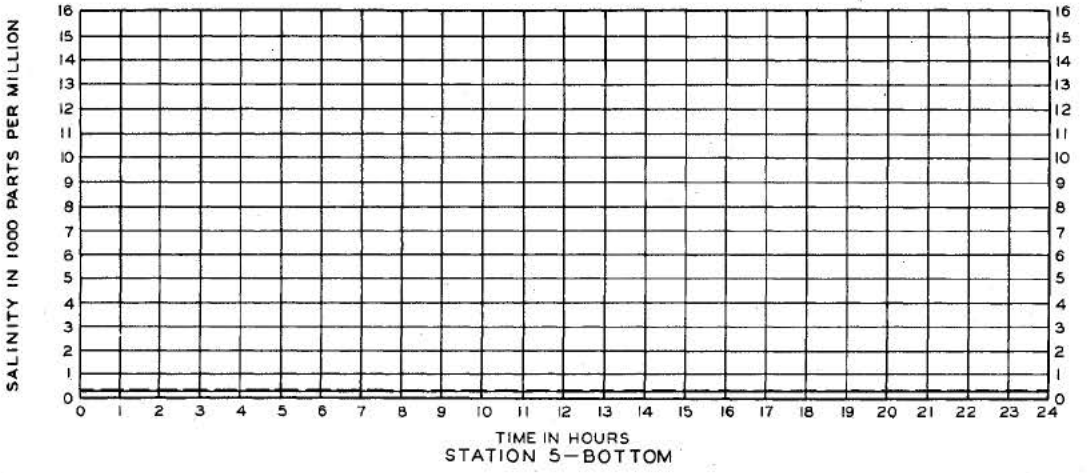
PLATE 11



STATION 5—SURFACE



STATION 5—MID-DEPTH



STATION 5—BOTTOM

LEGEND

——— PROTOTYPE SALINITIES

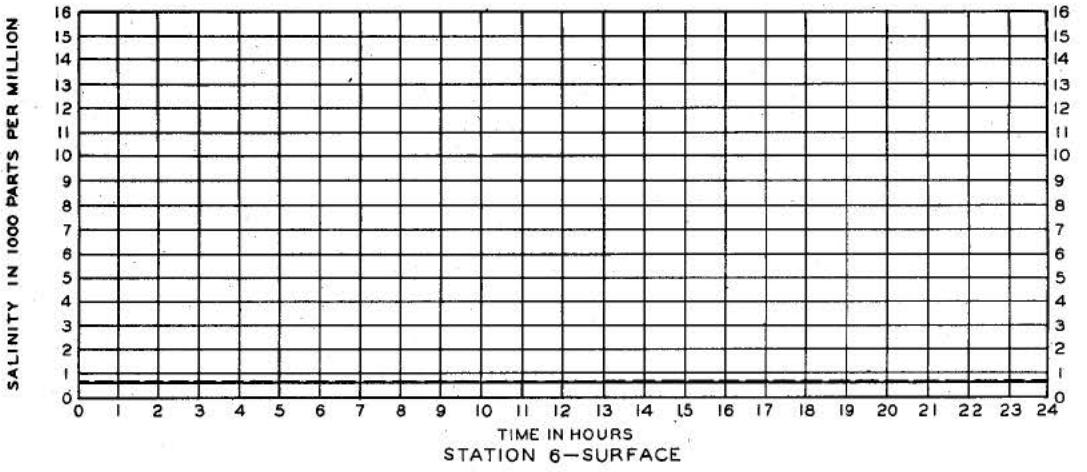
– – – – MODEL SALINITIES

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

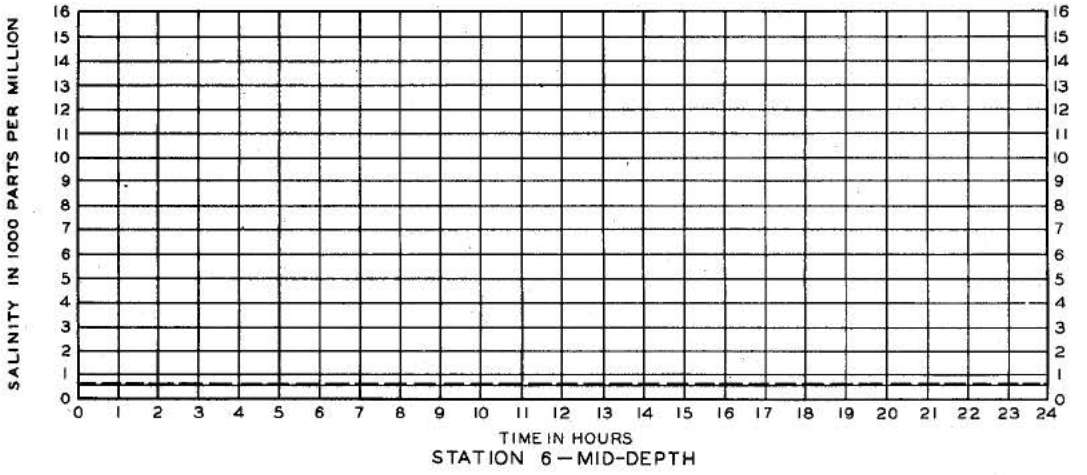
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

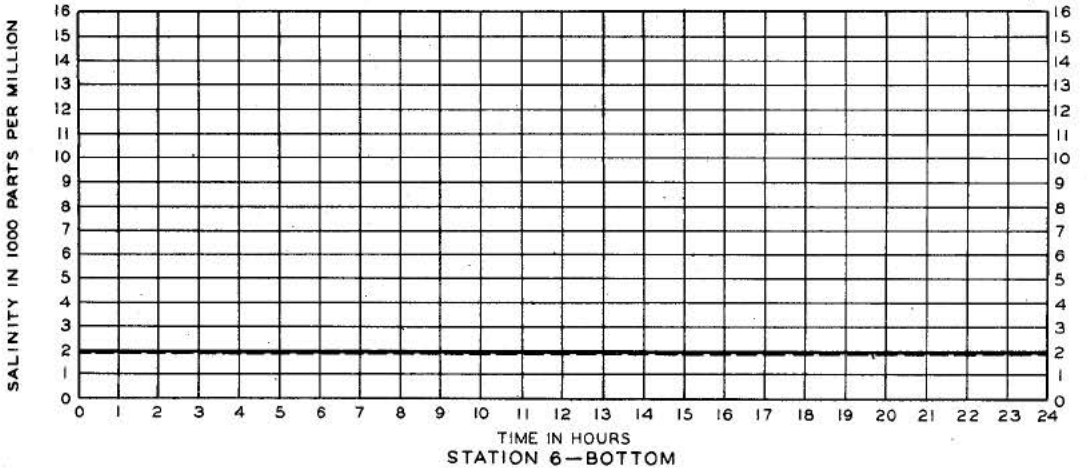
PLATE 12



STATION 6—SURFACE



STATION 6—MID-DEPTH



STATION 6—BOTTOM

LEGEND

——— PROTOTYPE SALINITIES

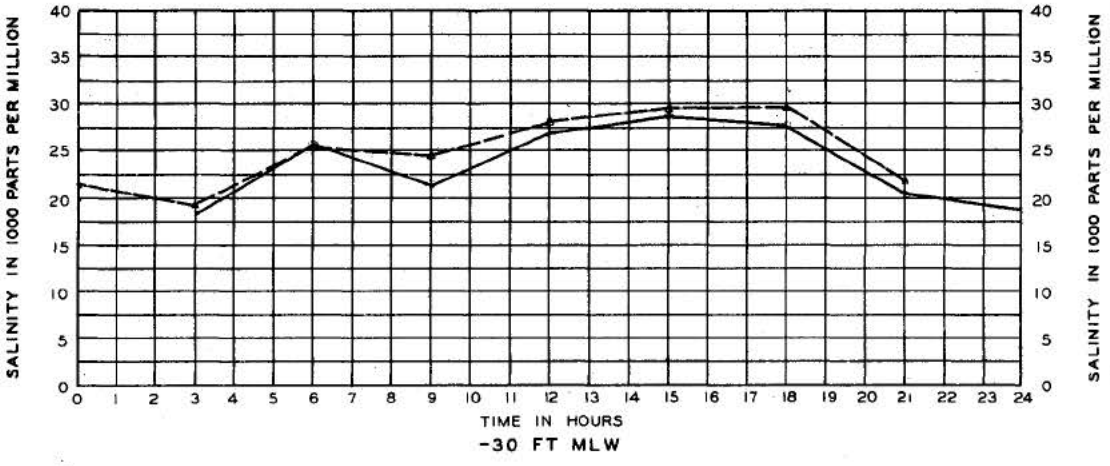
– – – – MODEL SALINITIES

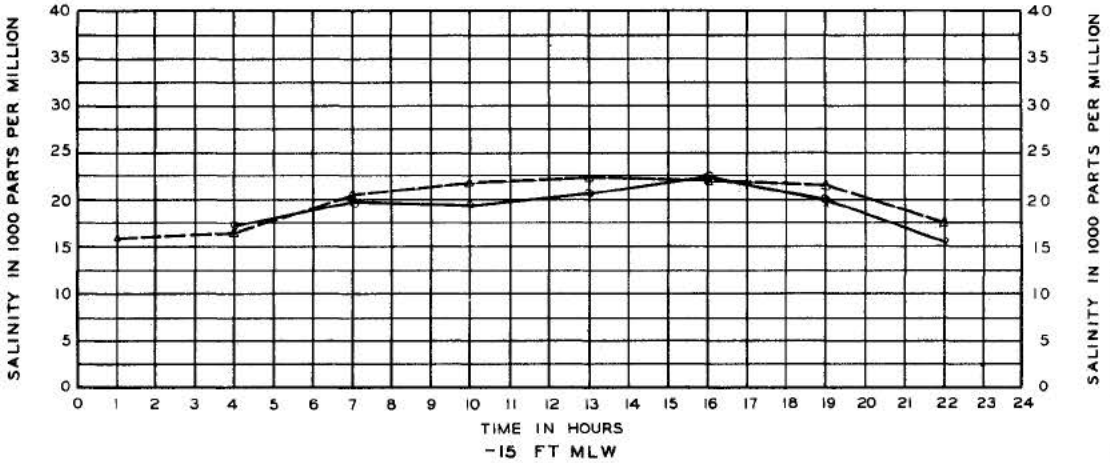
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOON'S TRANSIT OF CAMERON MERIDIAN.

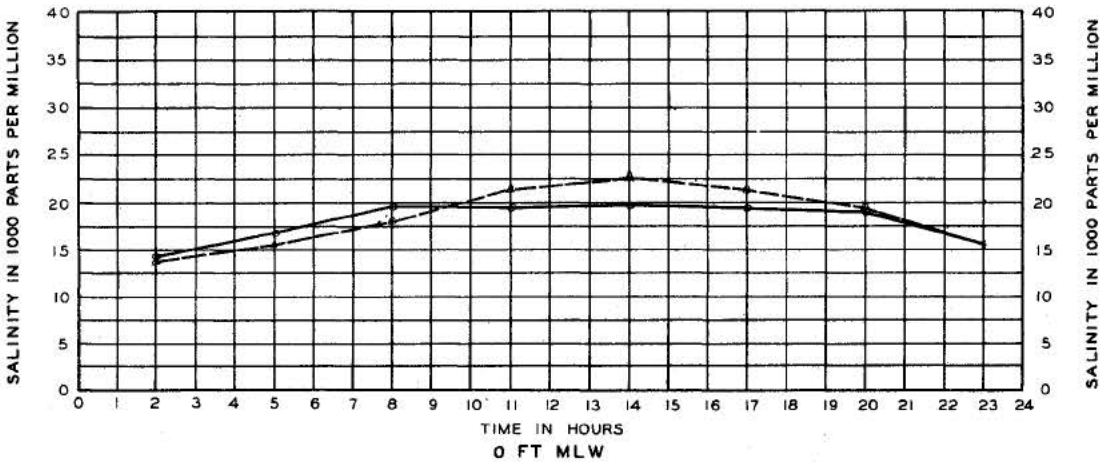
MODEL REPRODUCTION OF PROTOTYPE SALINITIES

SPRING TIDE RIVER DISCHARGE 11,000 CFS

PLATE 13







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

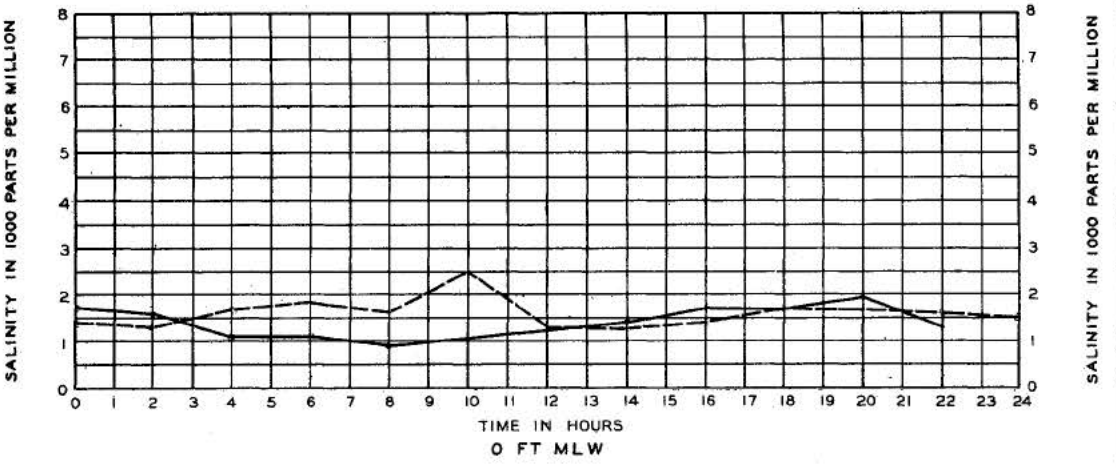
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

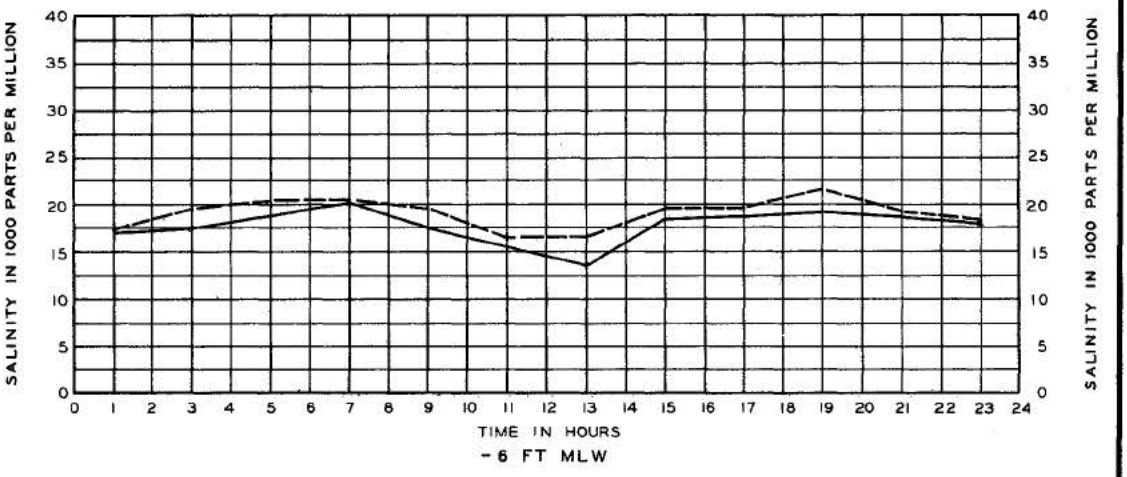
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

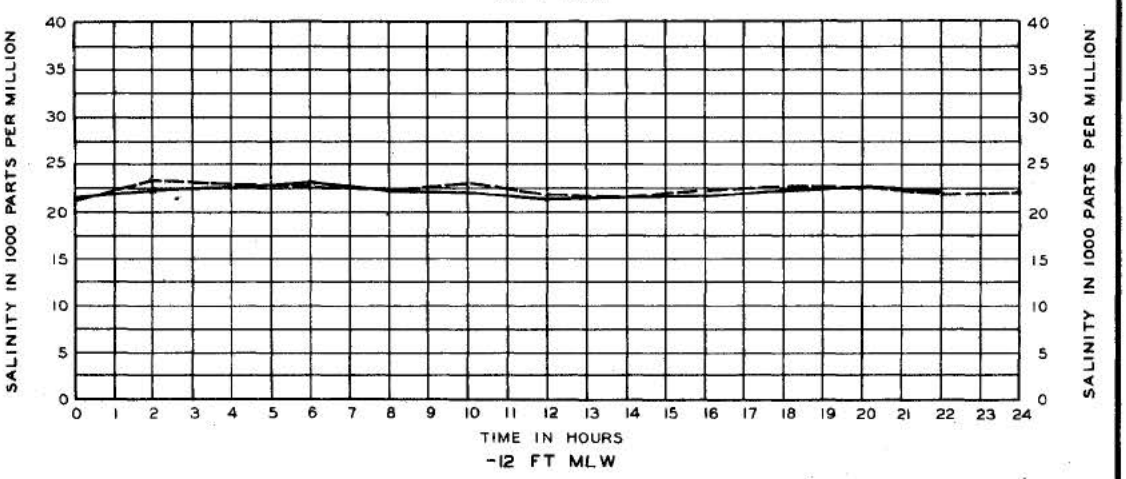
SALINITY AT STATION 1

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 1 AND 10

PLATE 14







LEGEND

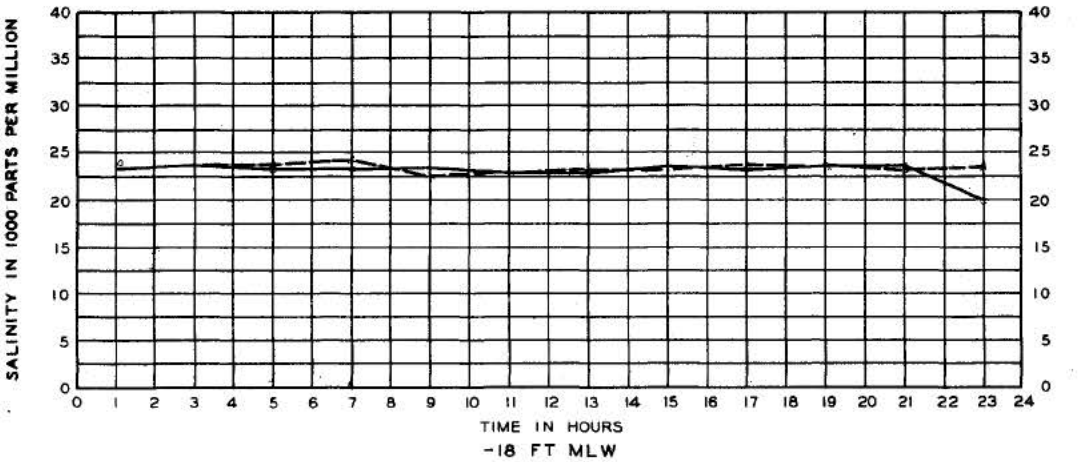
———— INDICATES TEST OF EXISTING CHANNEL DEPTH

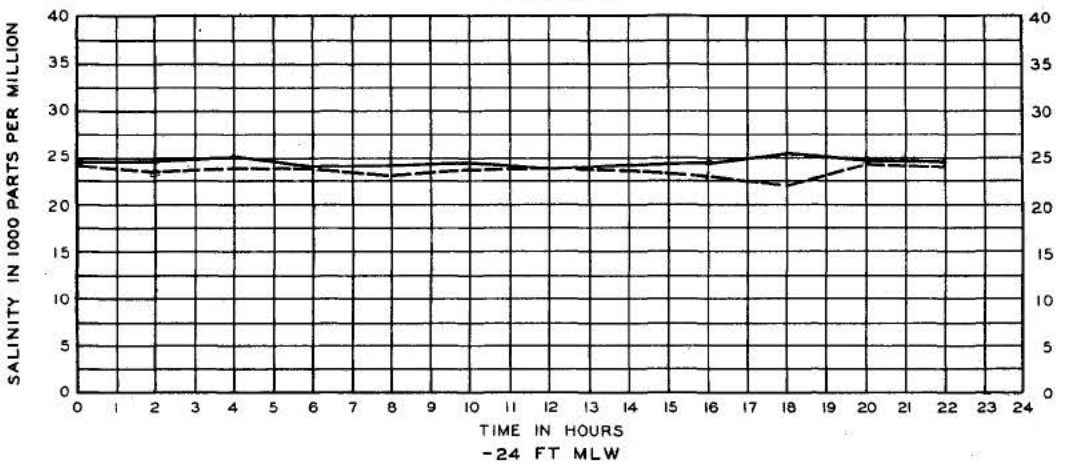
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

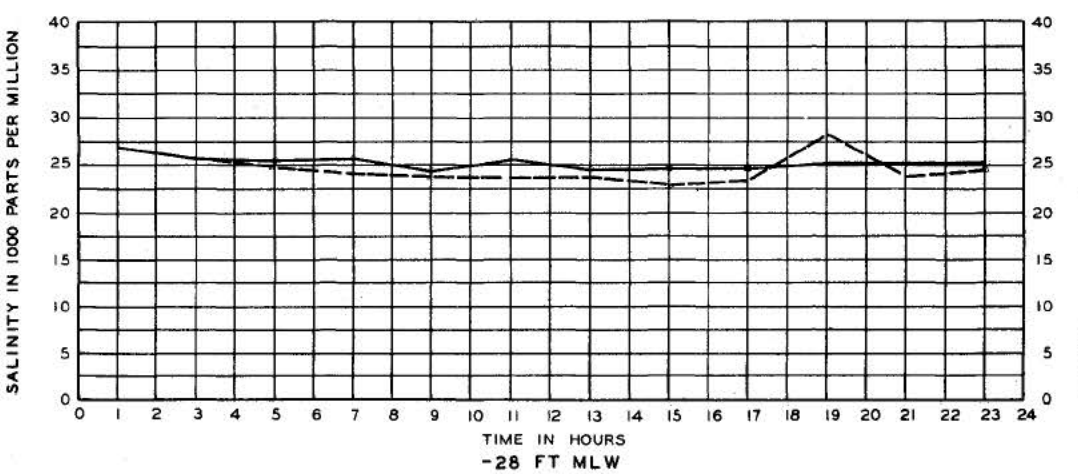
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 1 AND 10







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

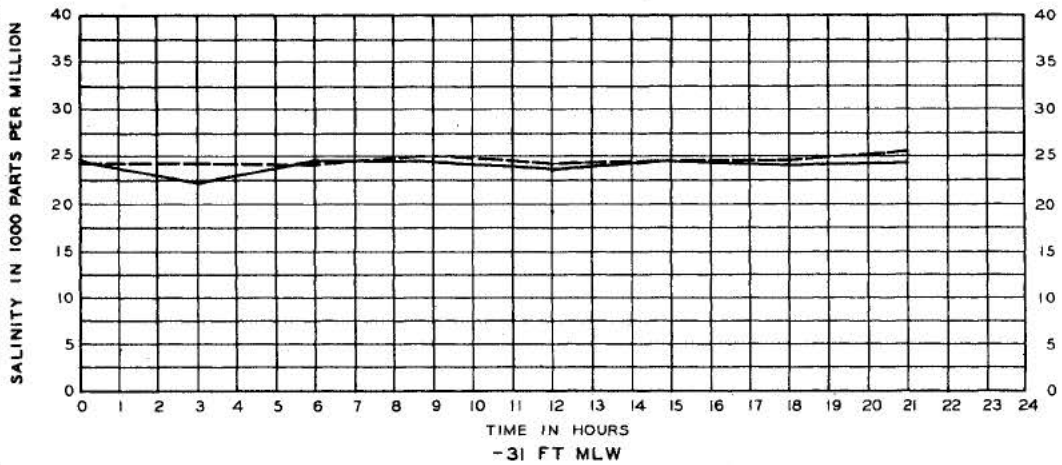
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

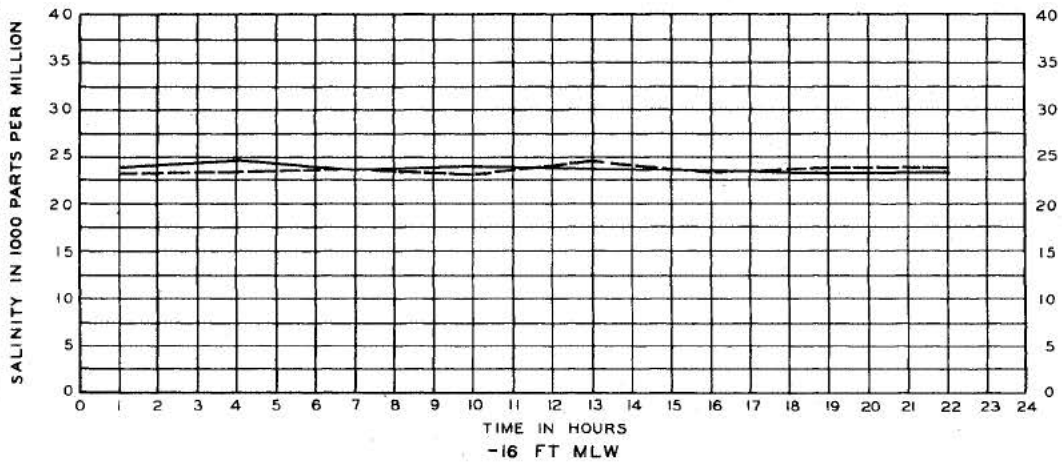
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

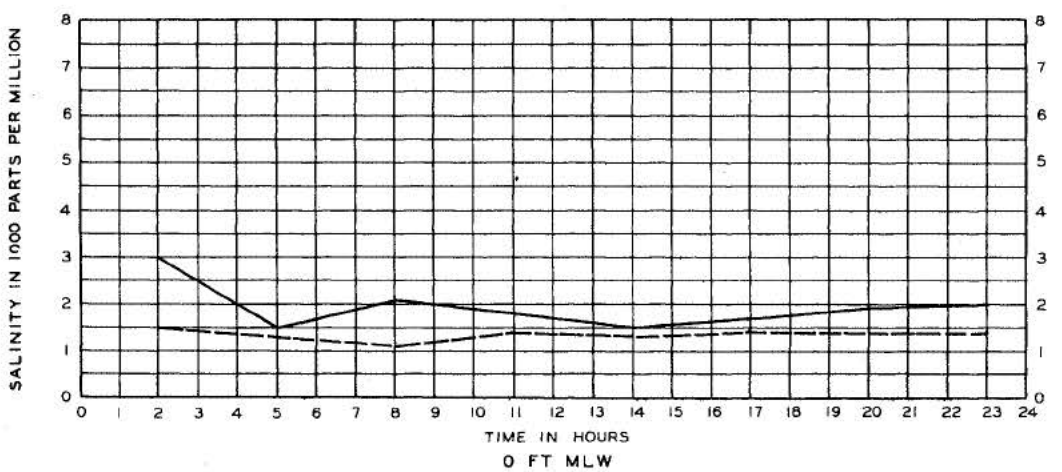
SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 1 AND 10

PLATE 16







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

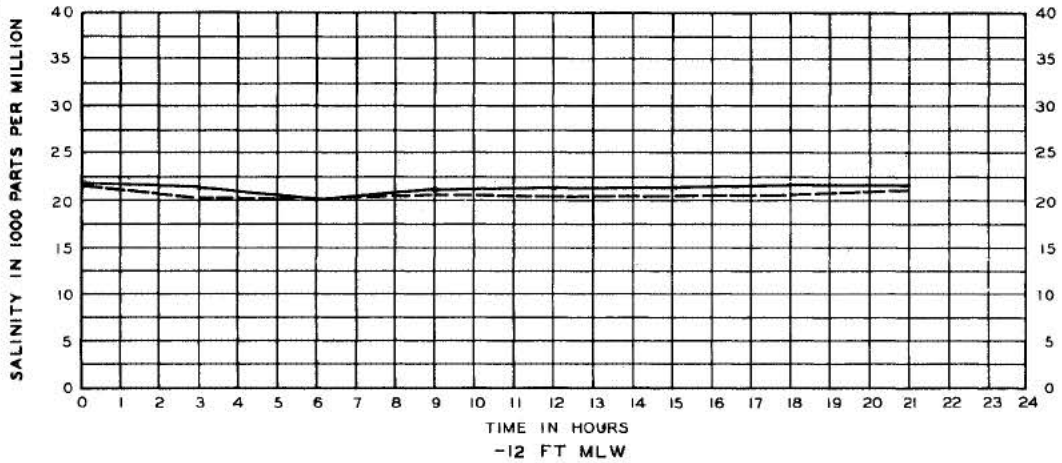
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

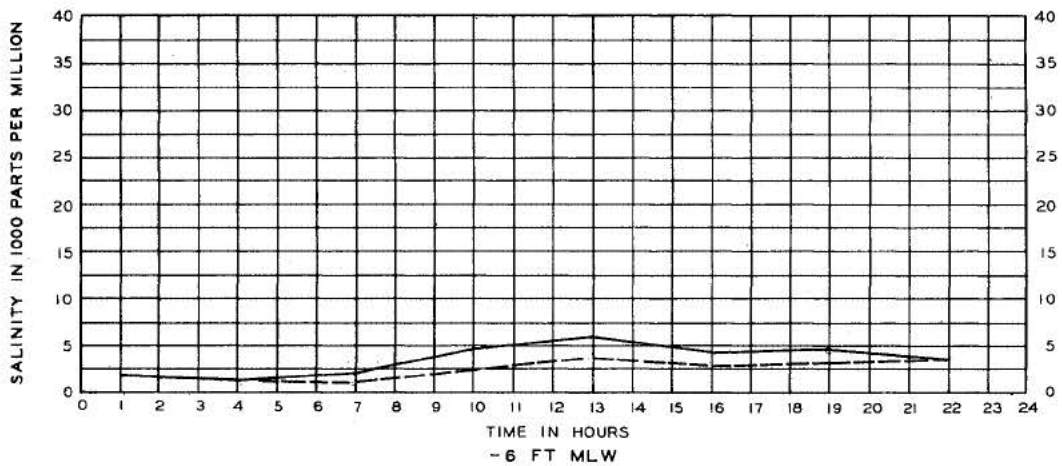
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

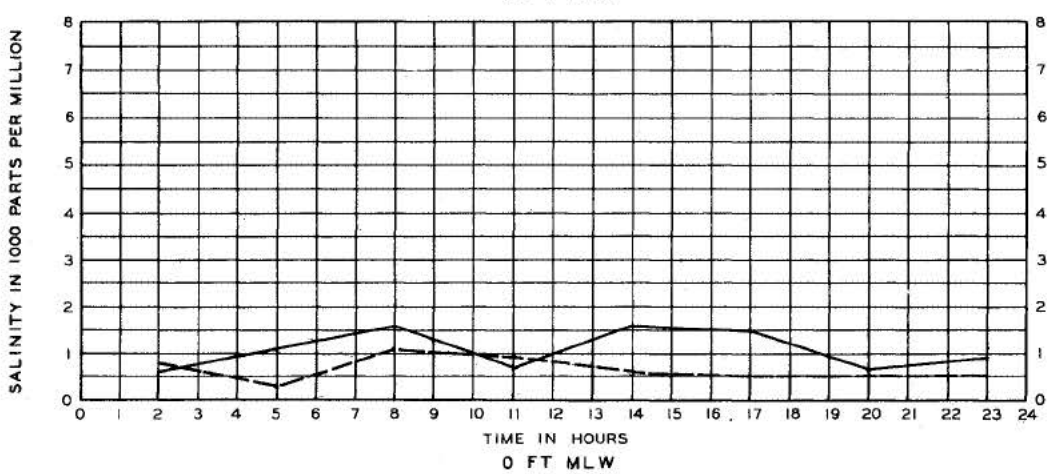
SALINITY AT STATION 3

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 1 AND 10

PLATE 17







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 5

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS I AND 10

PLATE 18

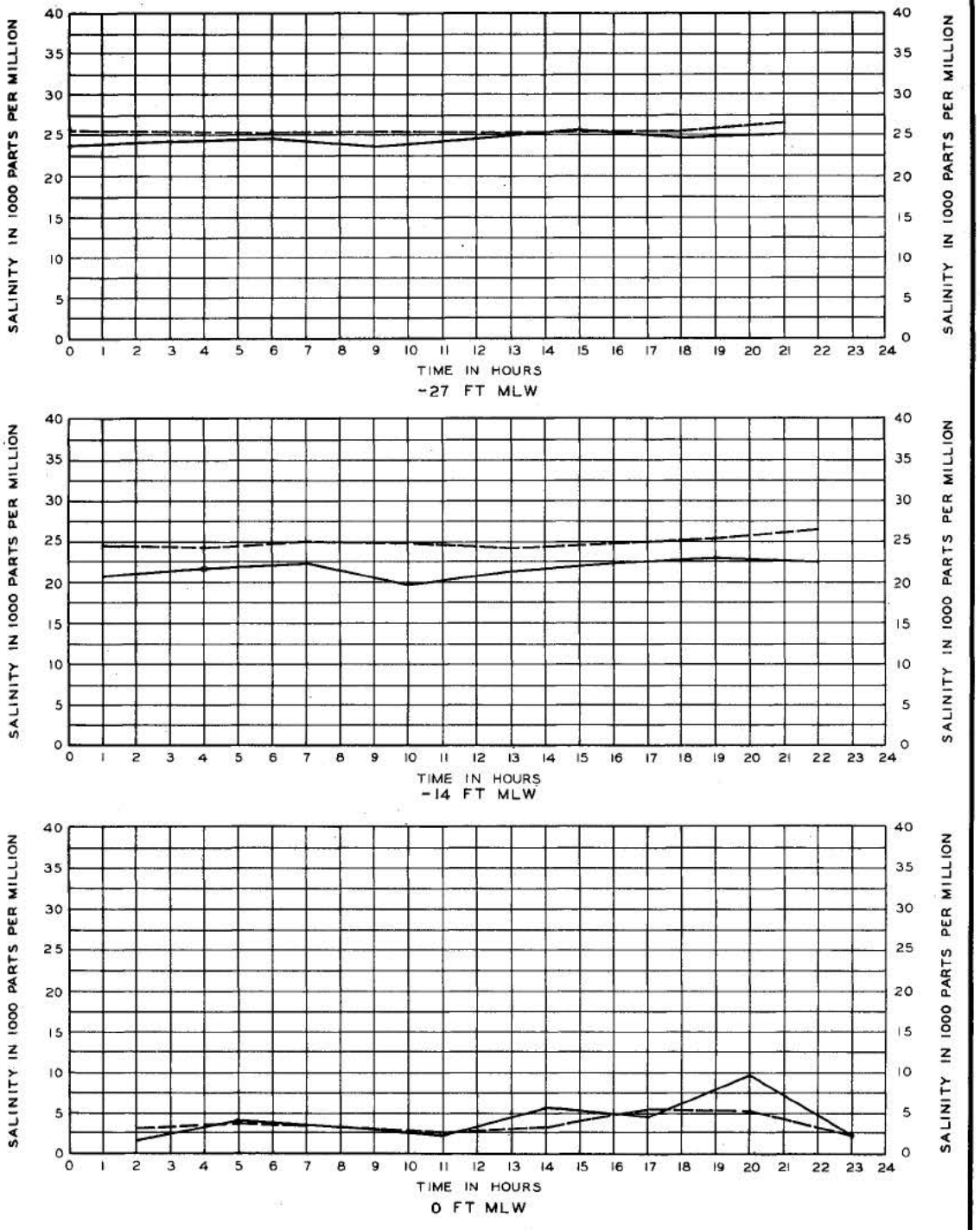
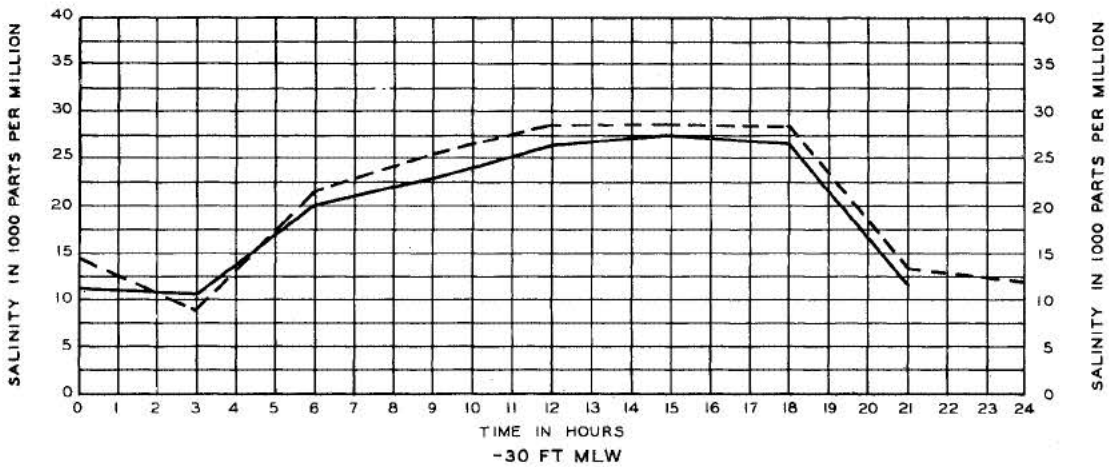
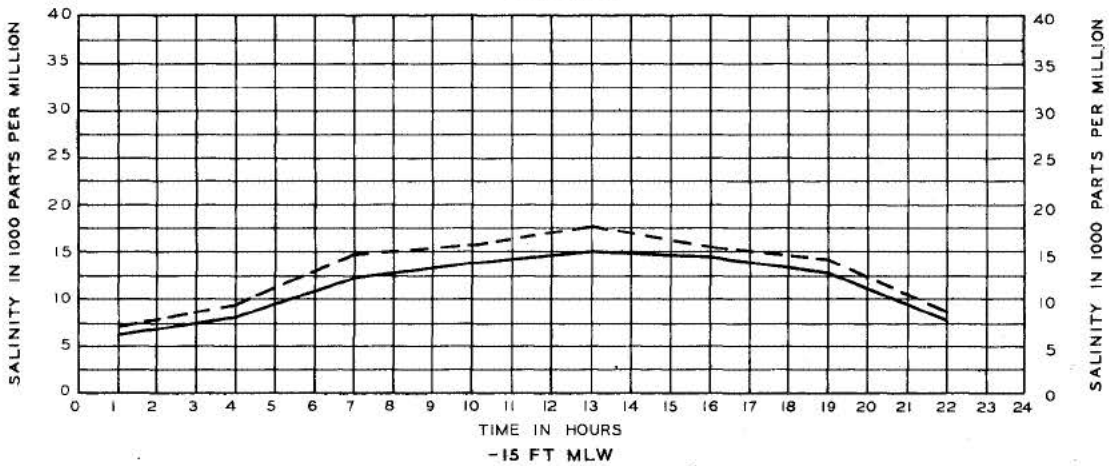
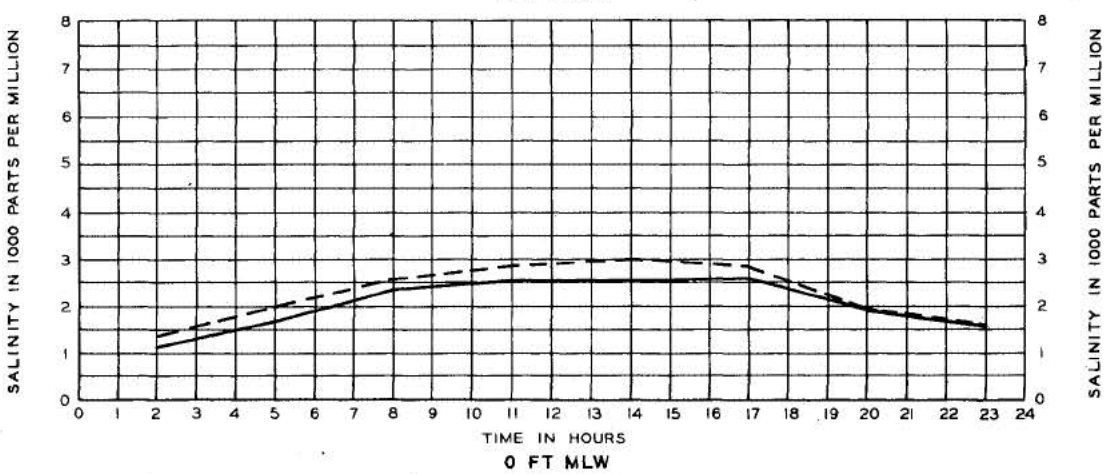

SALINITY IN 1000 PARTS PER MILLION
TIME IN HOURS
-27 FT MLW
SALINITY IN 1000 PARTS PER MILLION
TIME IN HOURS
-14 FT MLW
SALINITY IN 1000 PARTS PER MILLION
TIME IN HOURS
0 FT MLW
LEGEND
INDICATES TEST OF EXISTING CHANNEL DEPTH
INDICATES TEST OF PROPOSED CHANNEL DEPTH
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.
SALINITY AT STATION 6
TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS I AND 10

PLATE 19







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

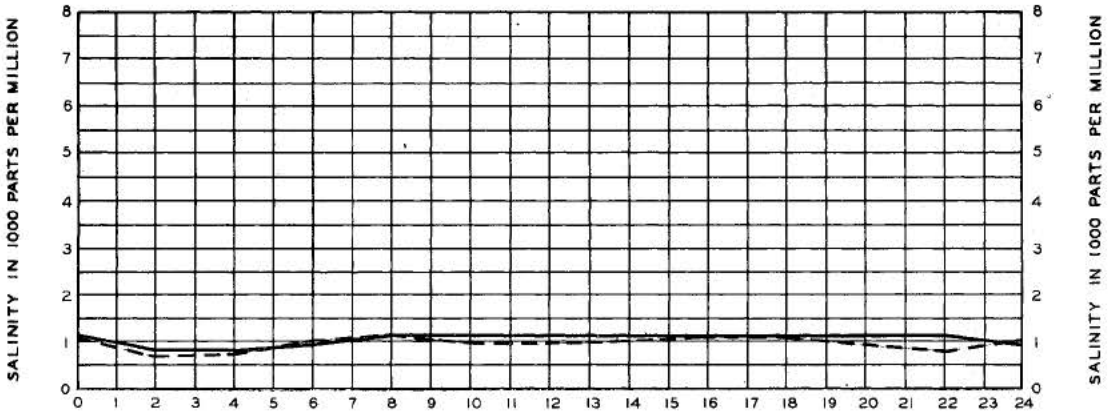
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

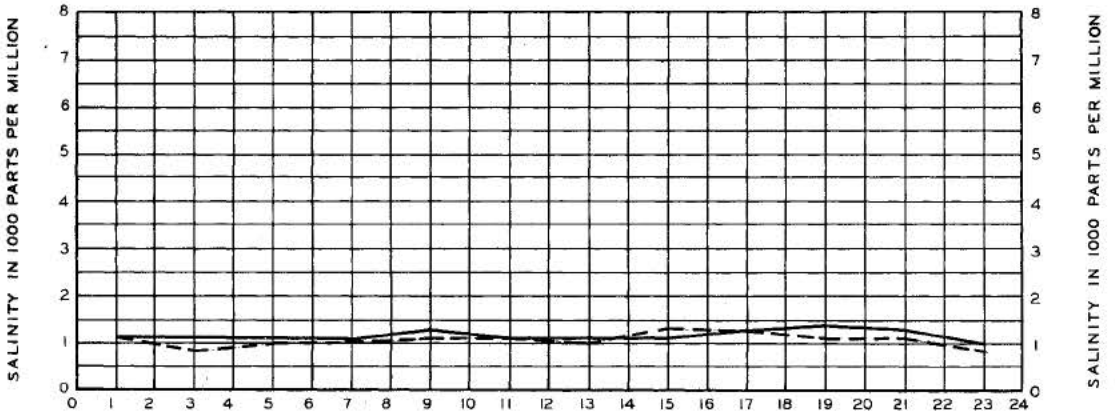
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

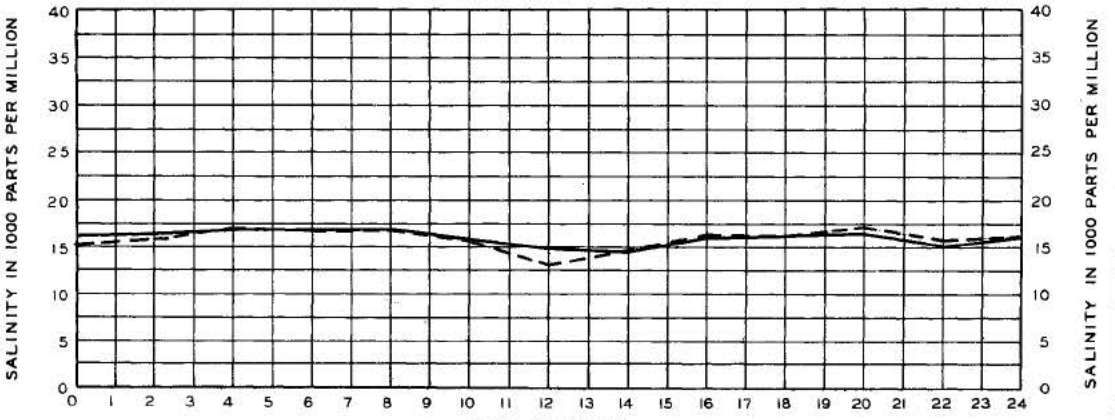
SALINITY AT STATION I

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 5000 CFS
TESTS 2 AND II

PLATE 20







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

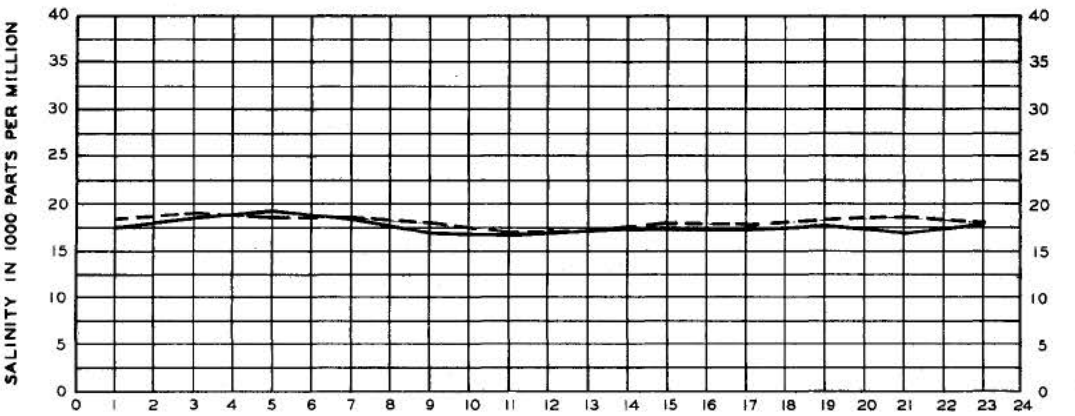
- - - - - - INDICATES TEST OF PROPOSED CHANNEL DEPTH

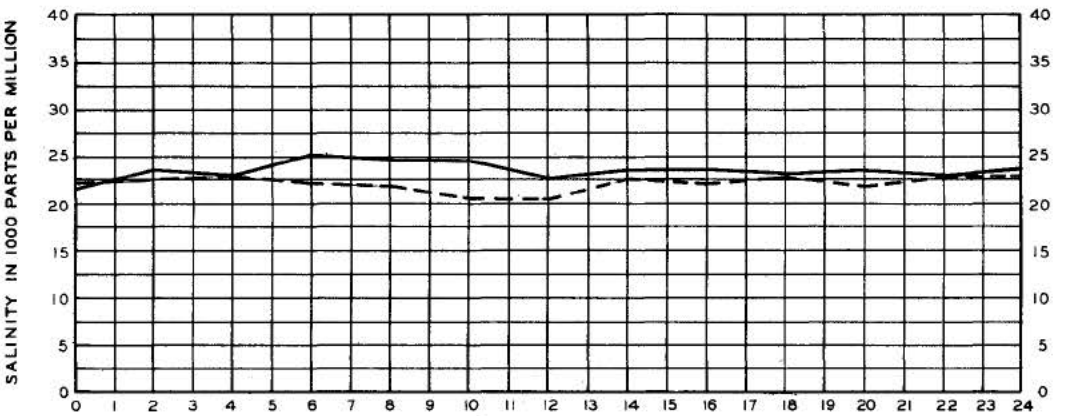
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

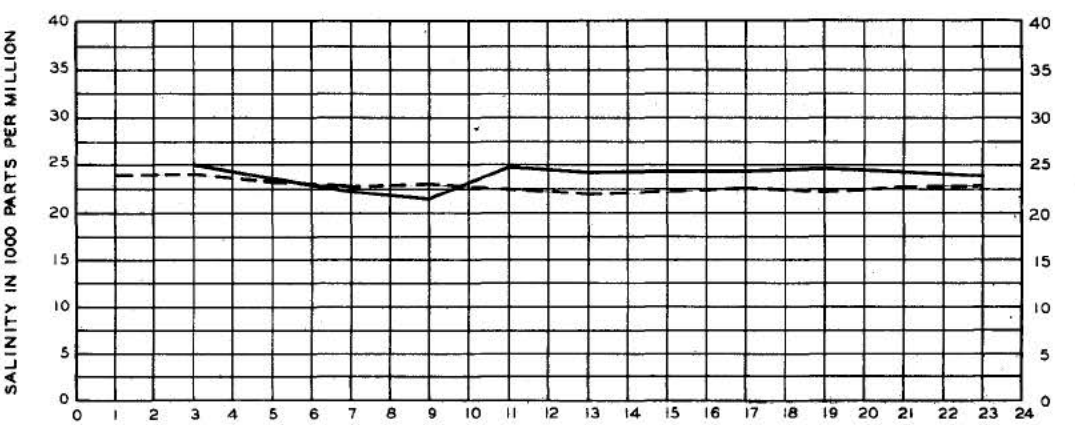
SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE-5000 CFS
TESTS 2 AND 11

PLATE 21







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

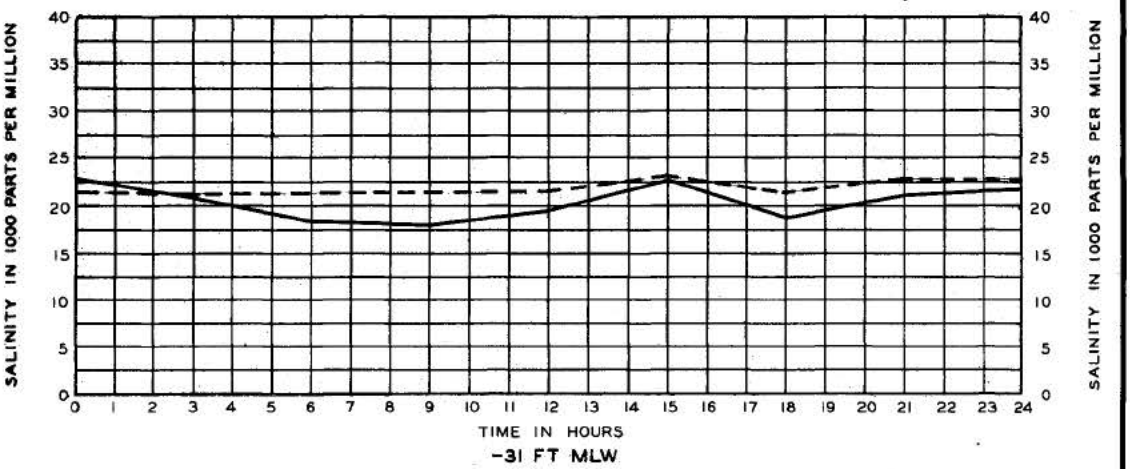
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

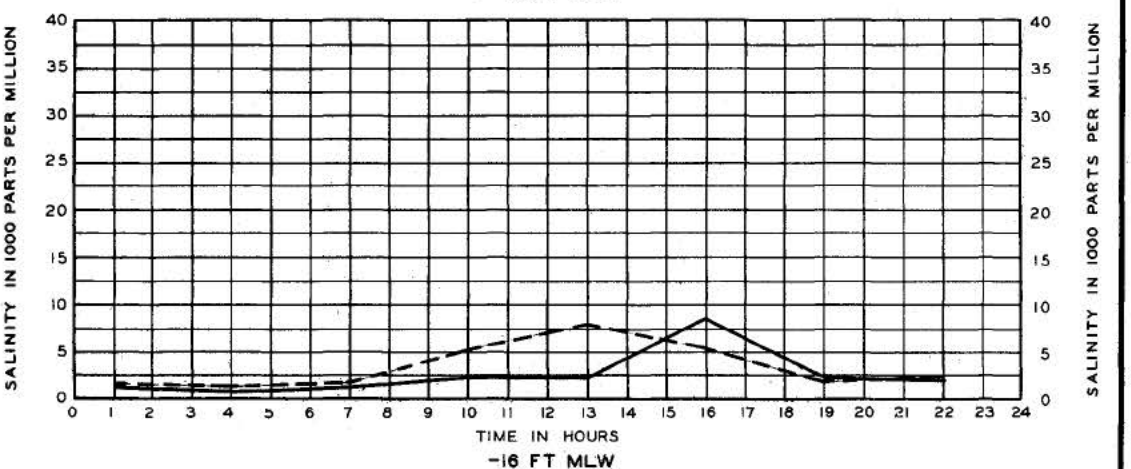
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

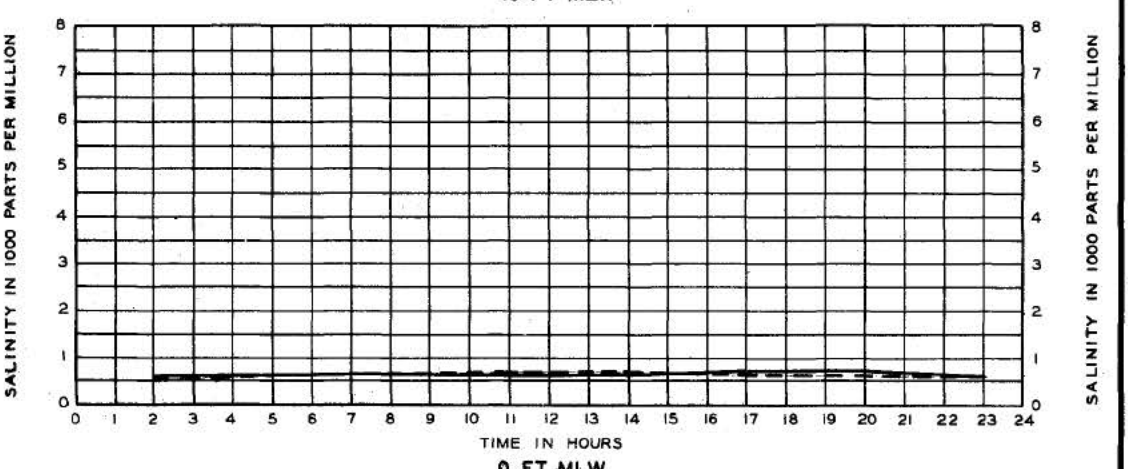
SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE-5000 CFS
TESTS 2 AND 11

PLATE 22







LEGEND

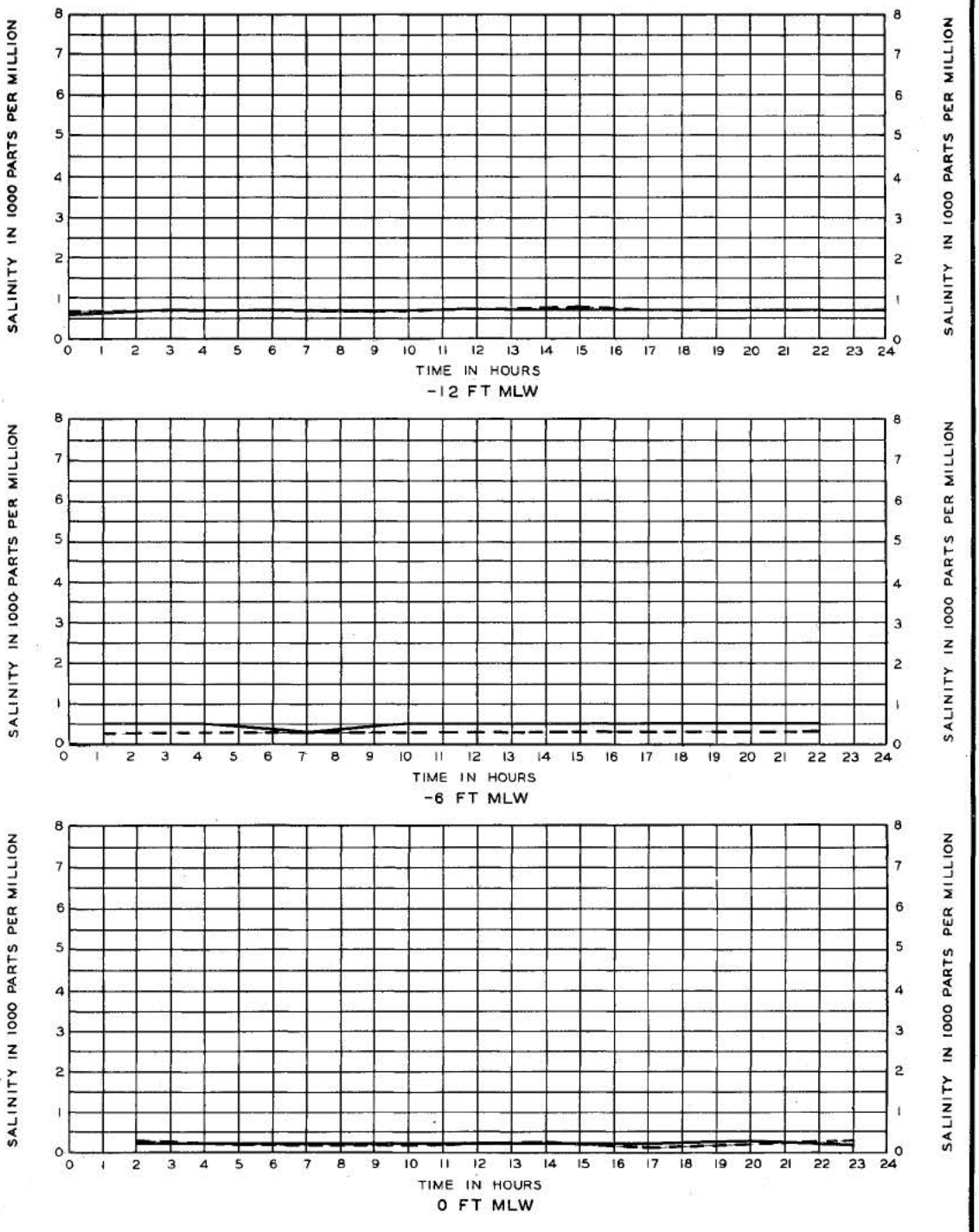
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 3

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE-5000 CFS
TESTS 2 AND 11



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

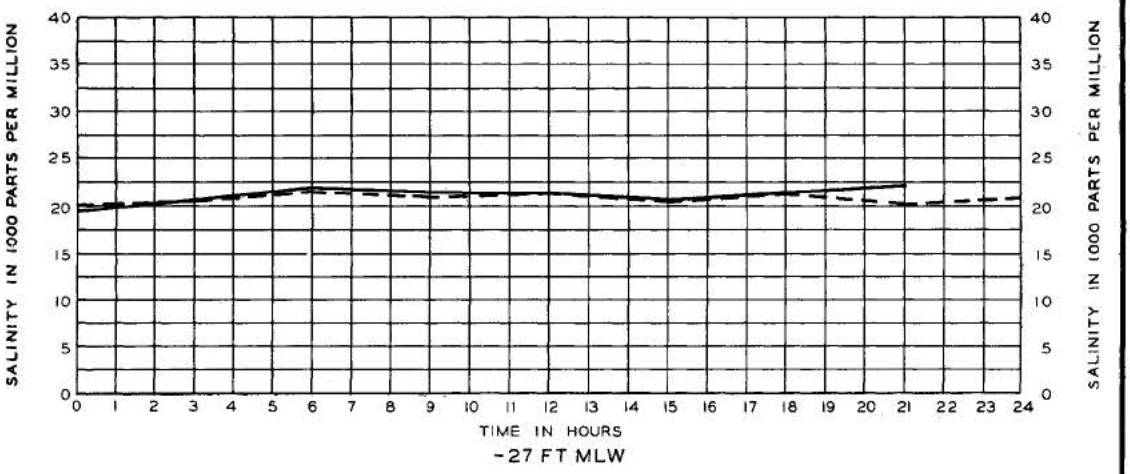
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

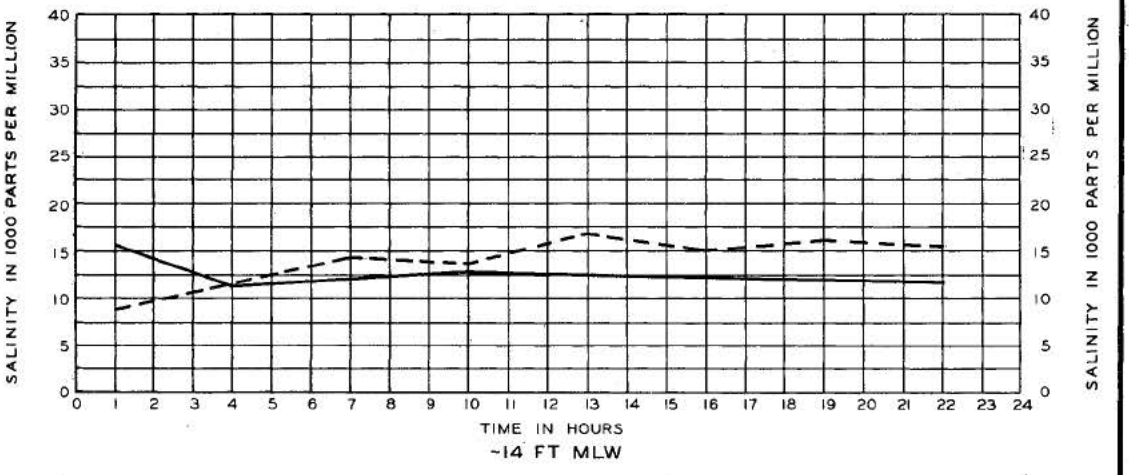
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

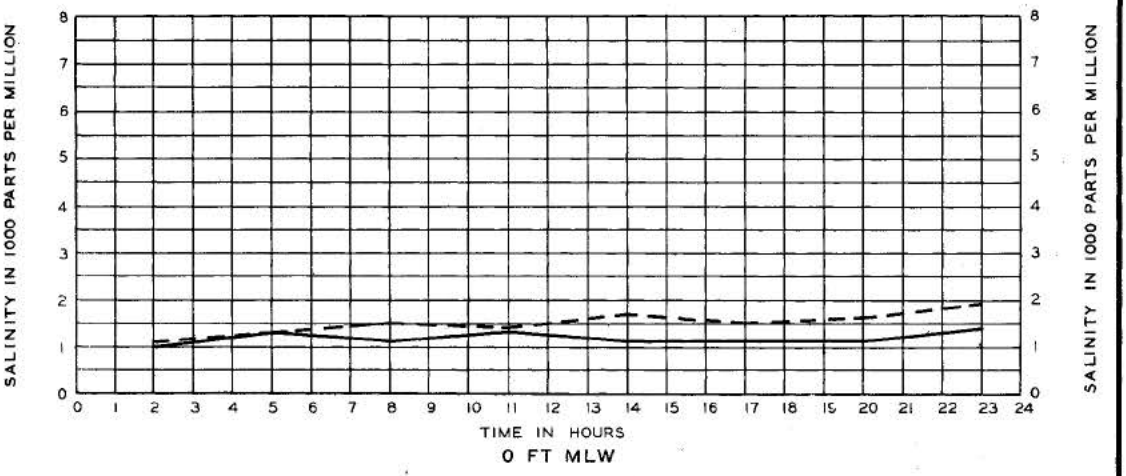
SALINITY AT STATION 5

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE-5000 CFS
TESTS 2 AND 11

PLATE 24







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

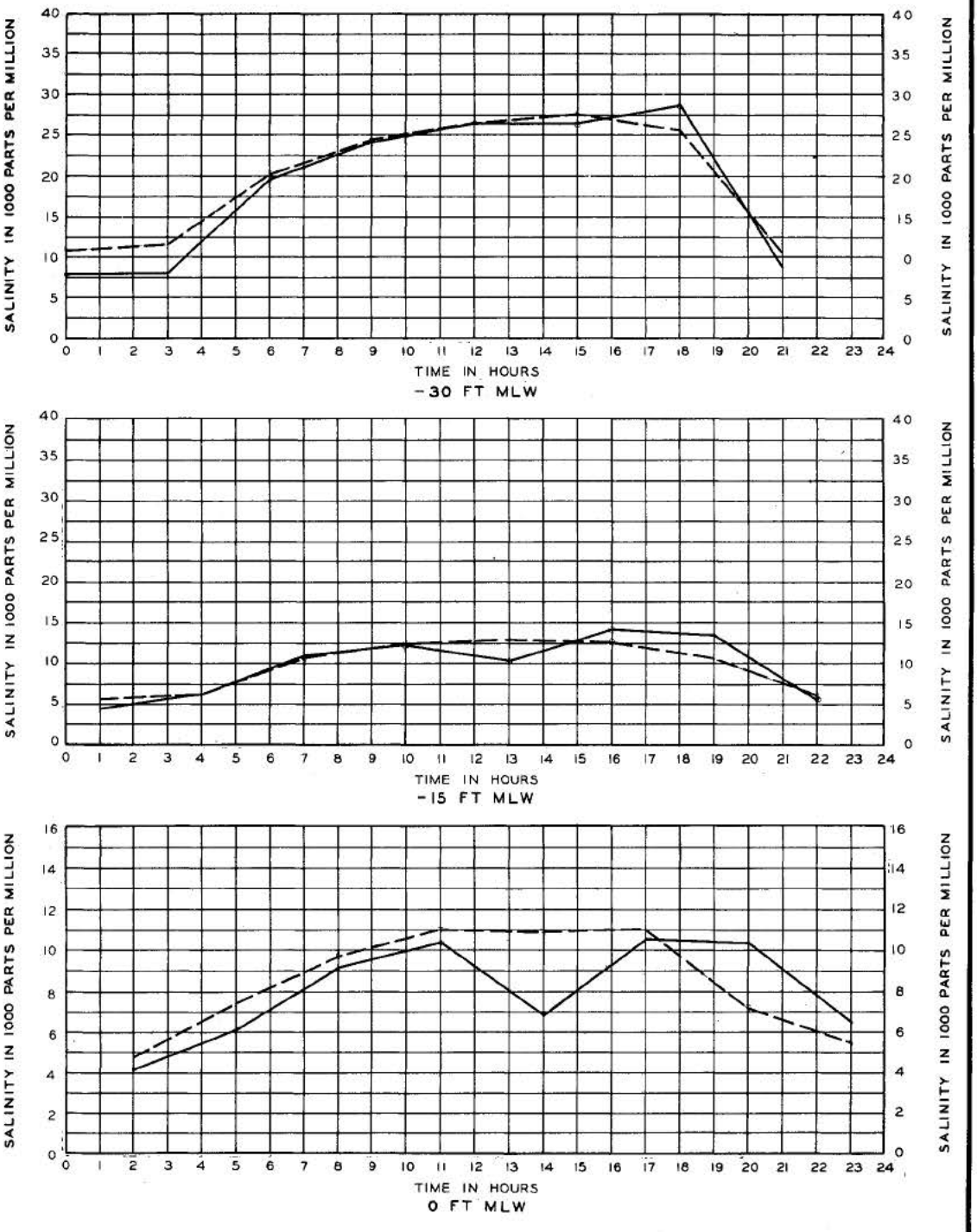
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 6

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE-5000 CFS
TESTS 2 AND 11

PLATE 25



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

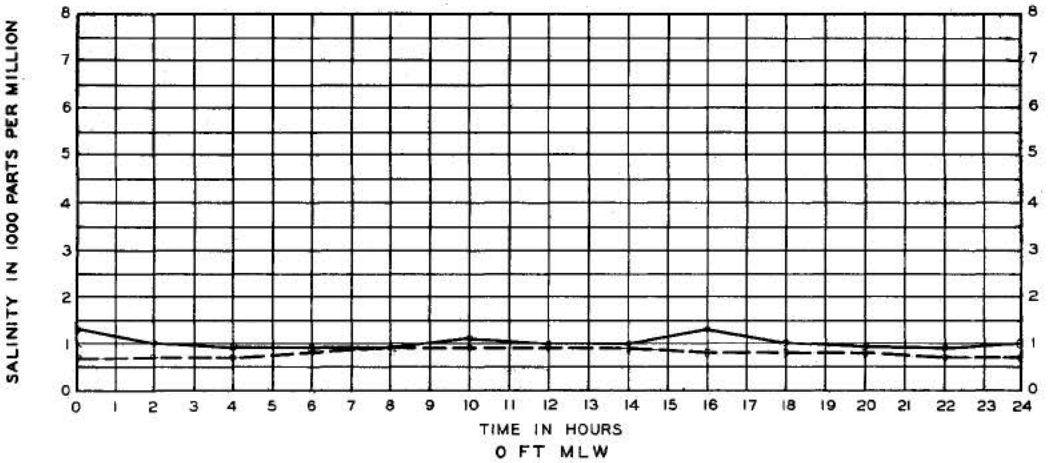
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

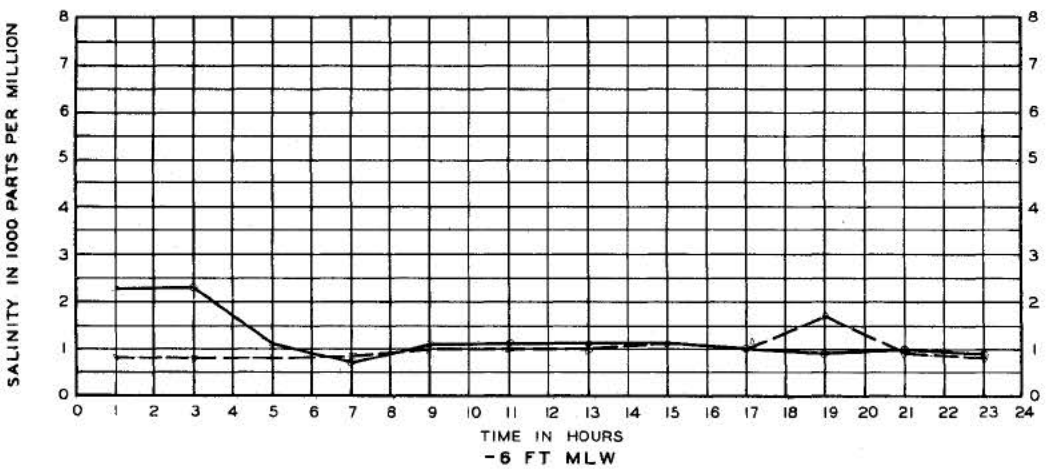
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

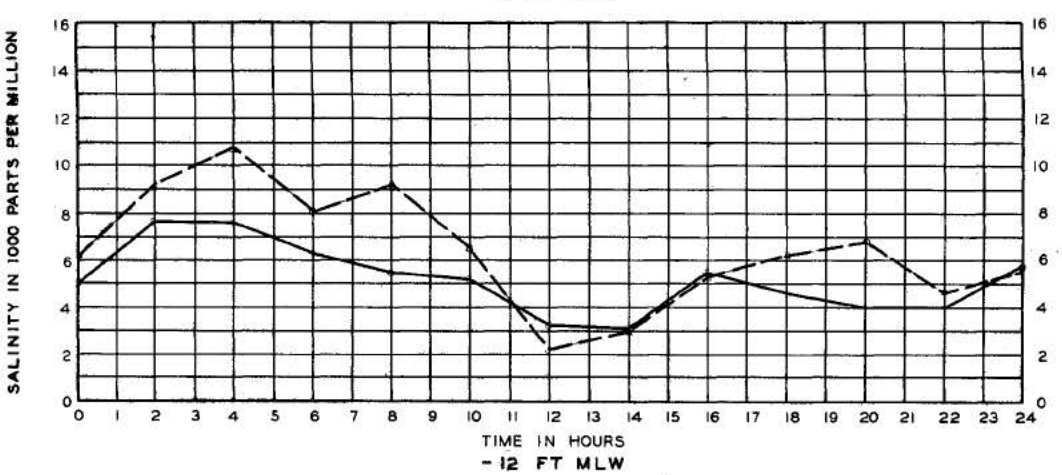
SALINITY AT STATION 1

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 3 AND 12

PLATE 26







LEGEND

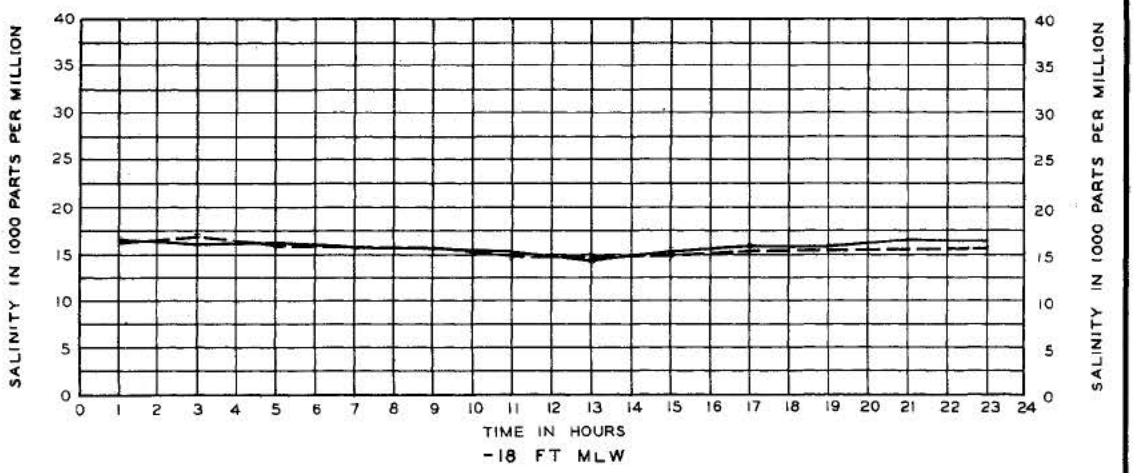
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

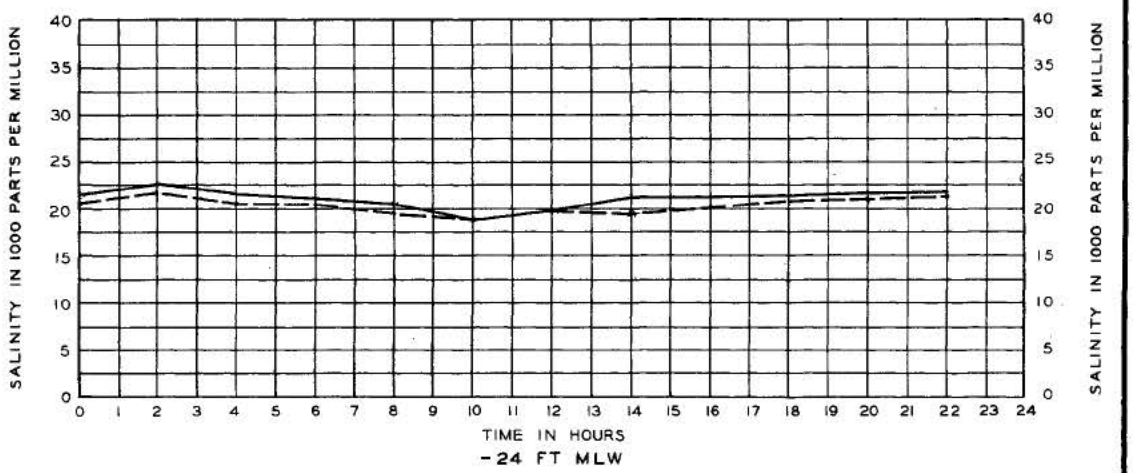
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

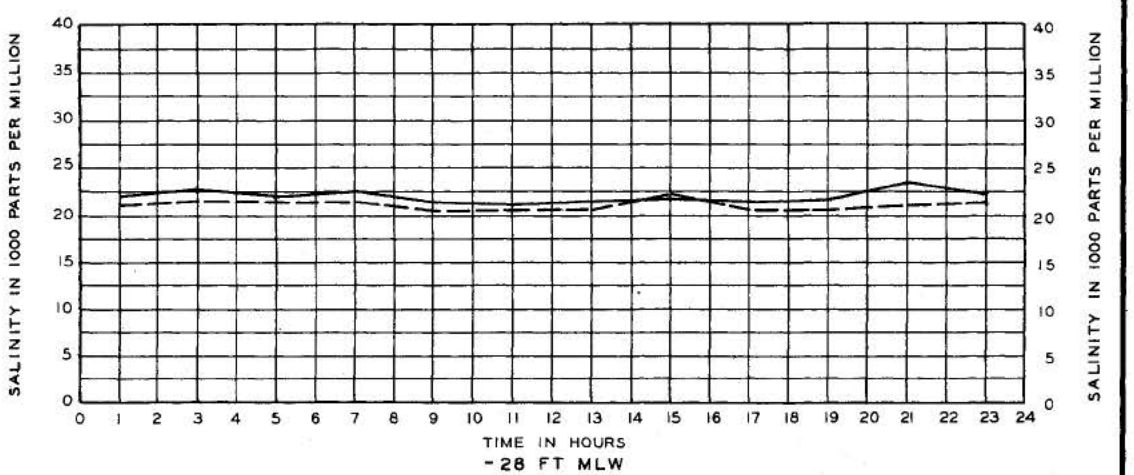
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 3 AND 12







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

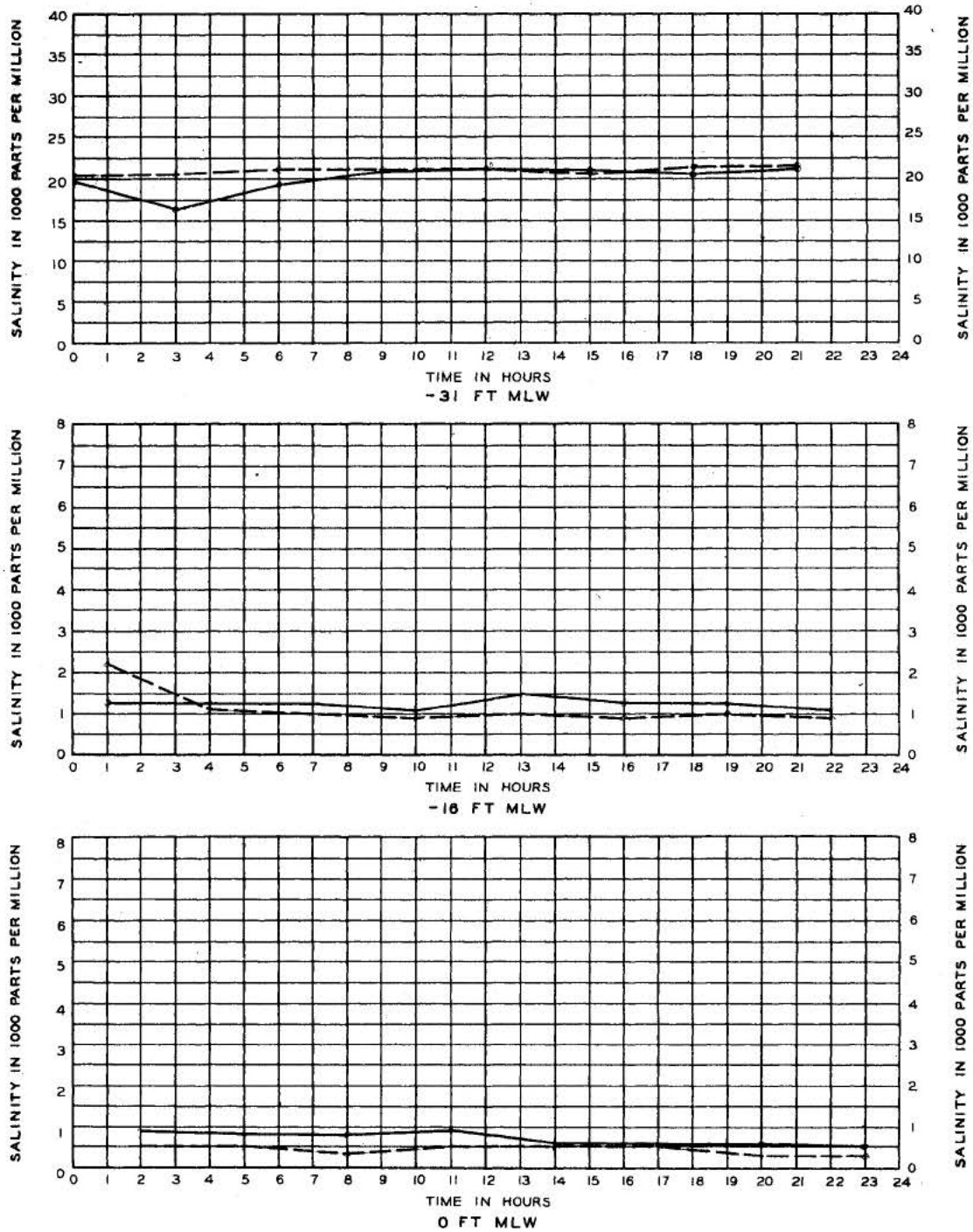
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE 7000 CFS.
TESTS 3 AND 12

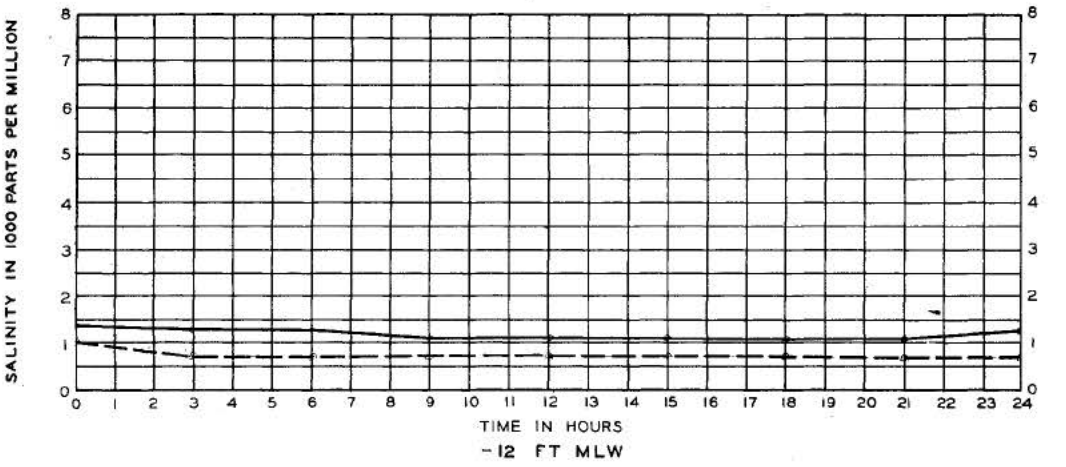
PLATE 28

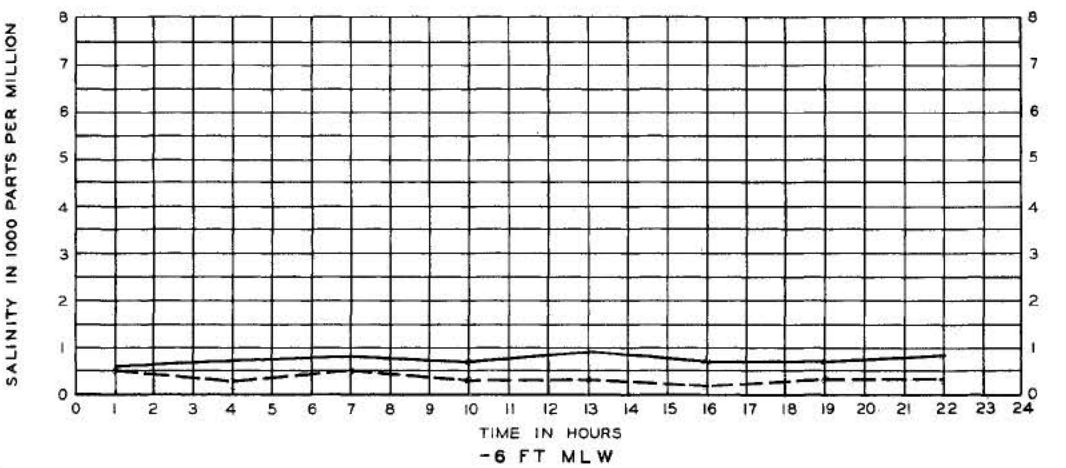


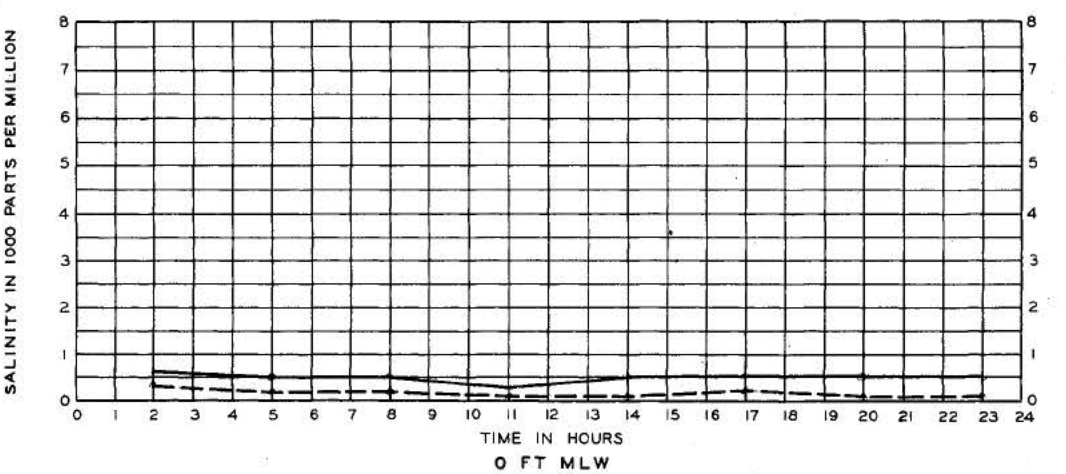
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 3

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 3 AND 12







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

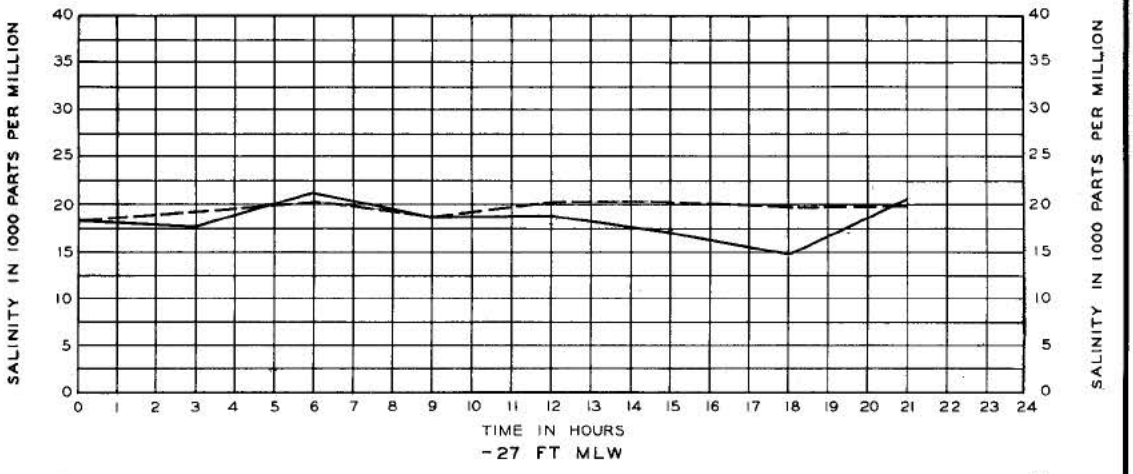
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

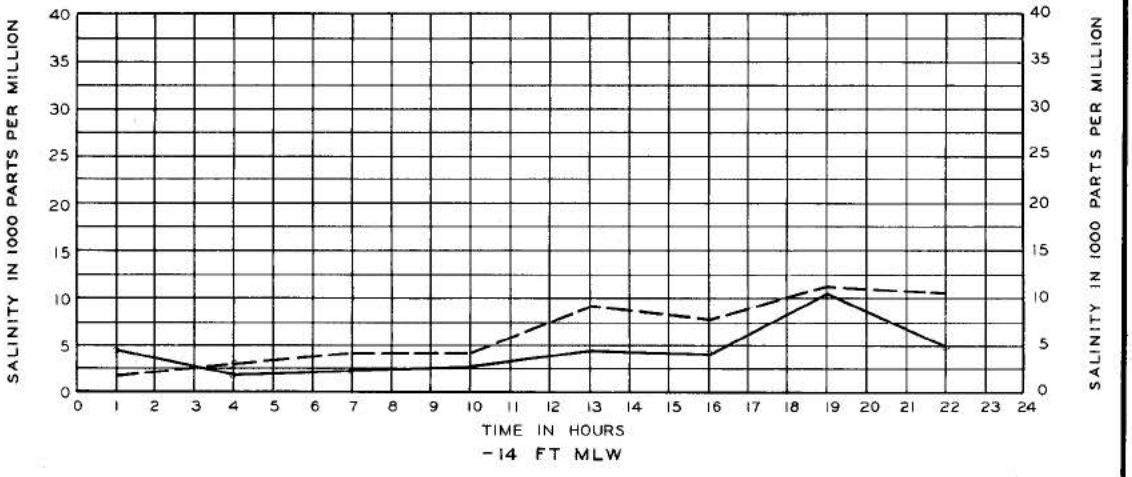
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

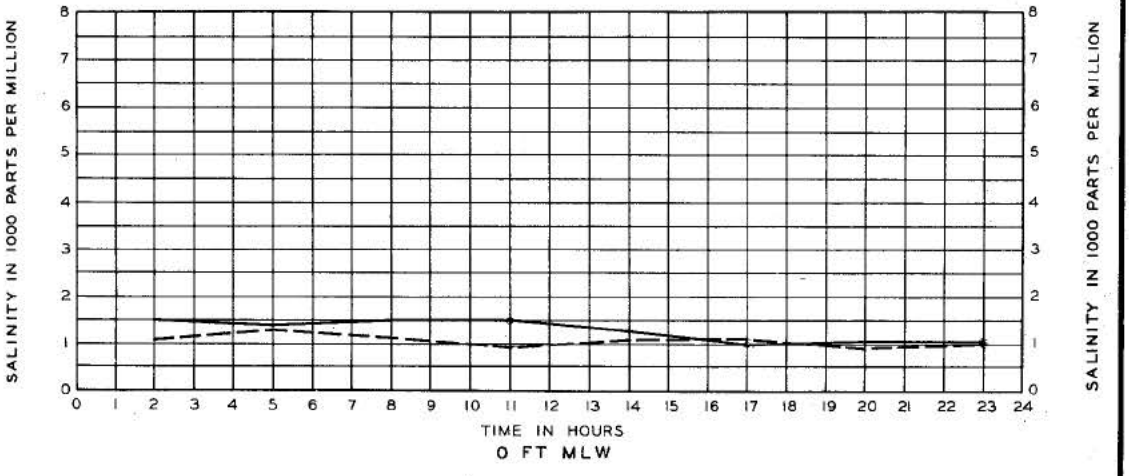
SALINITY AT STATION 5

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 3 AND 12

PLATE 30







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

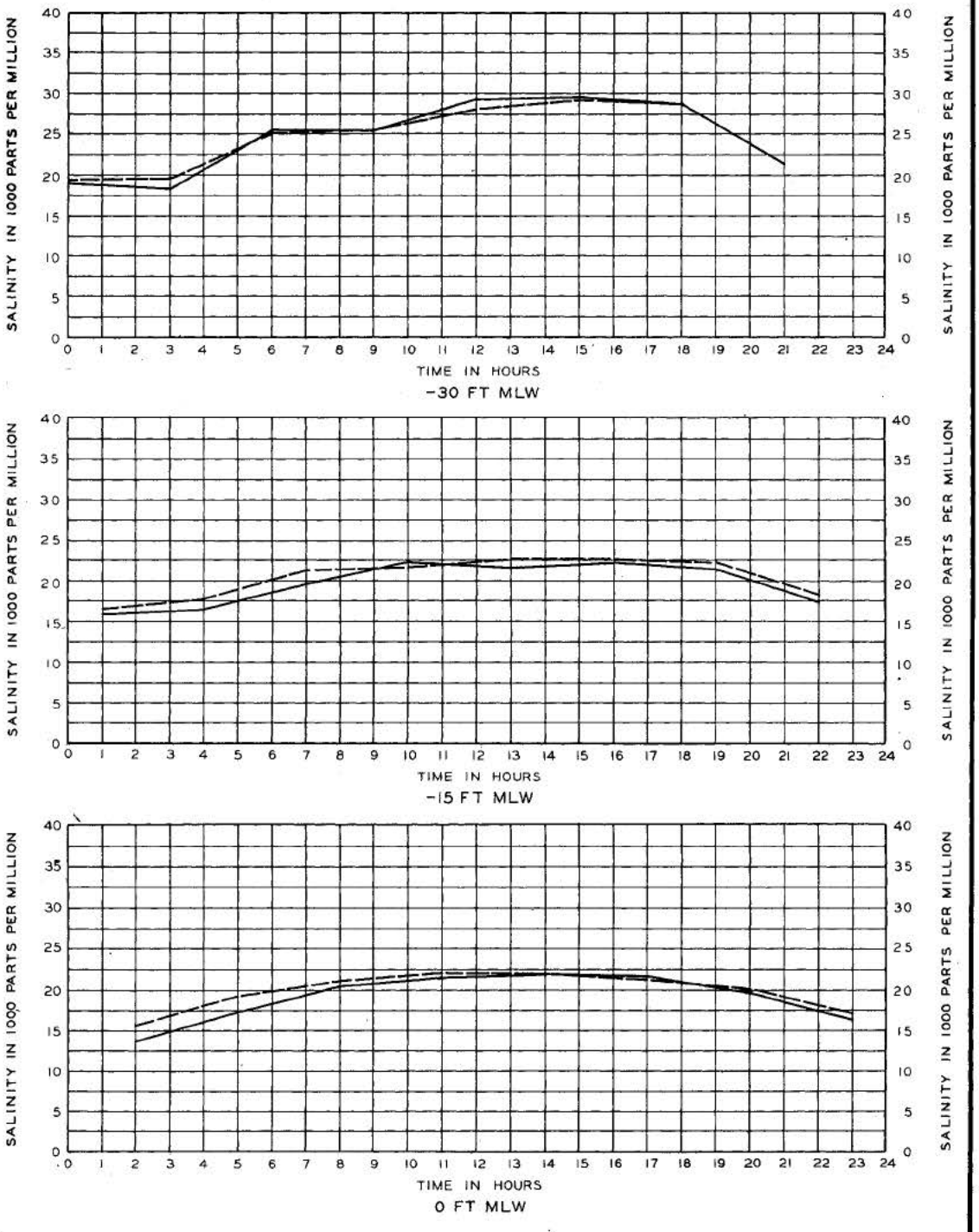
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.

SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 6

TIDAL FLOW IN INTRACOASTAL WATERWAY
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 3 AND 12



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

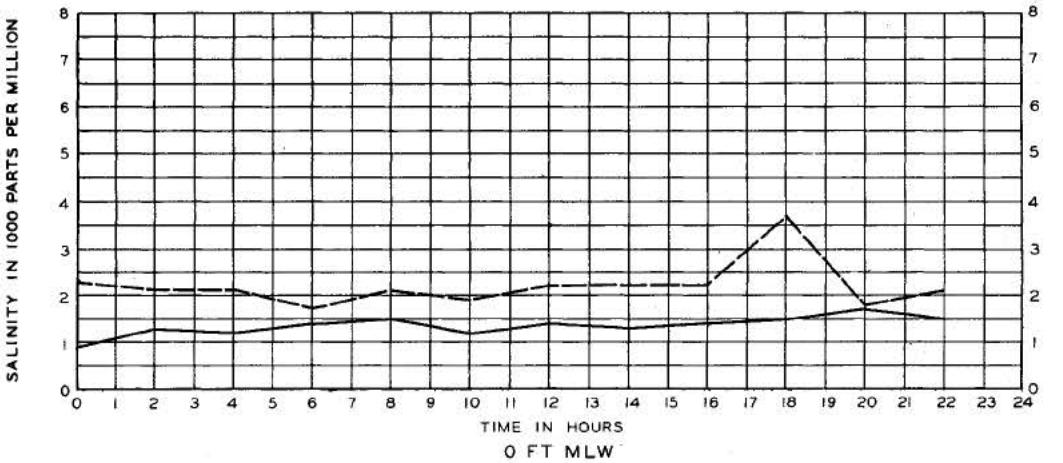
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

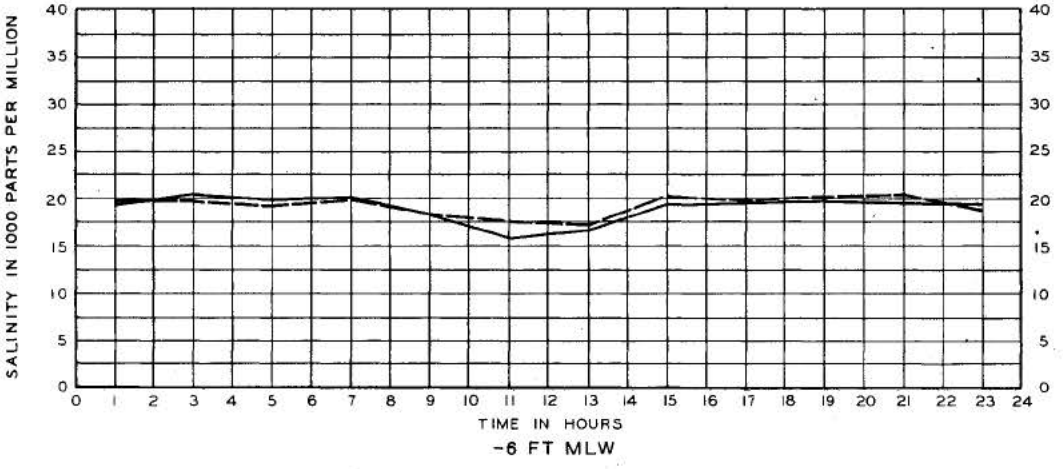
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

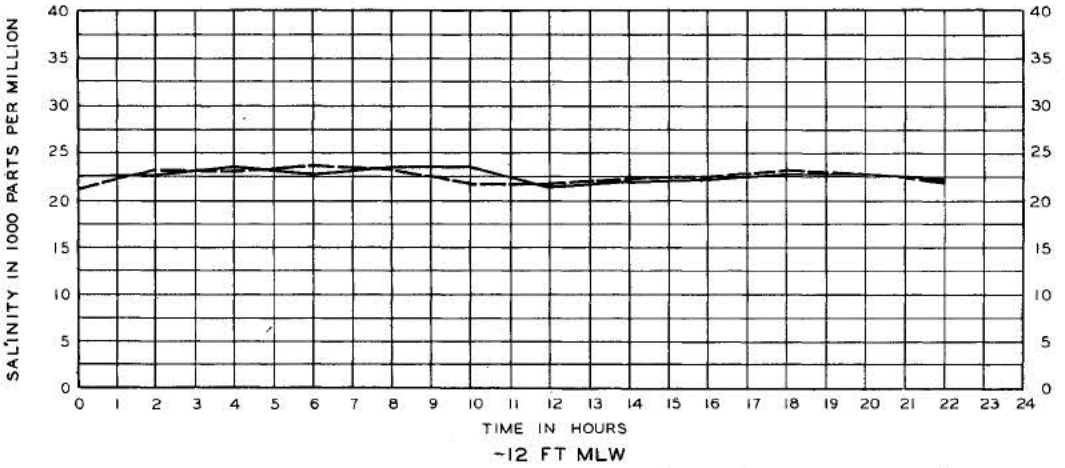
SALINITY AT STATION 1

EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 4 AND 13

PLATE 32







LEGEND

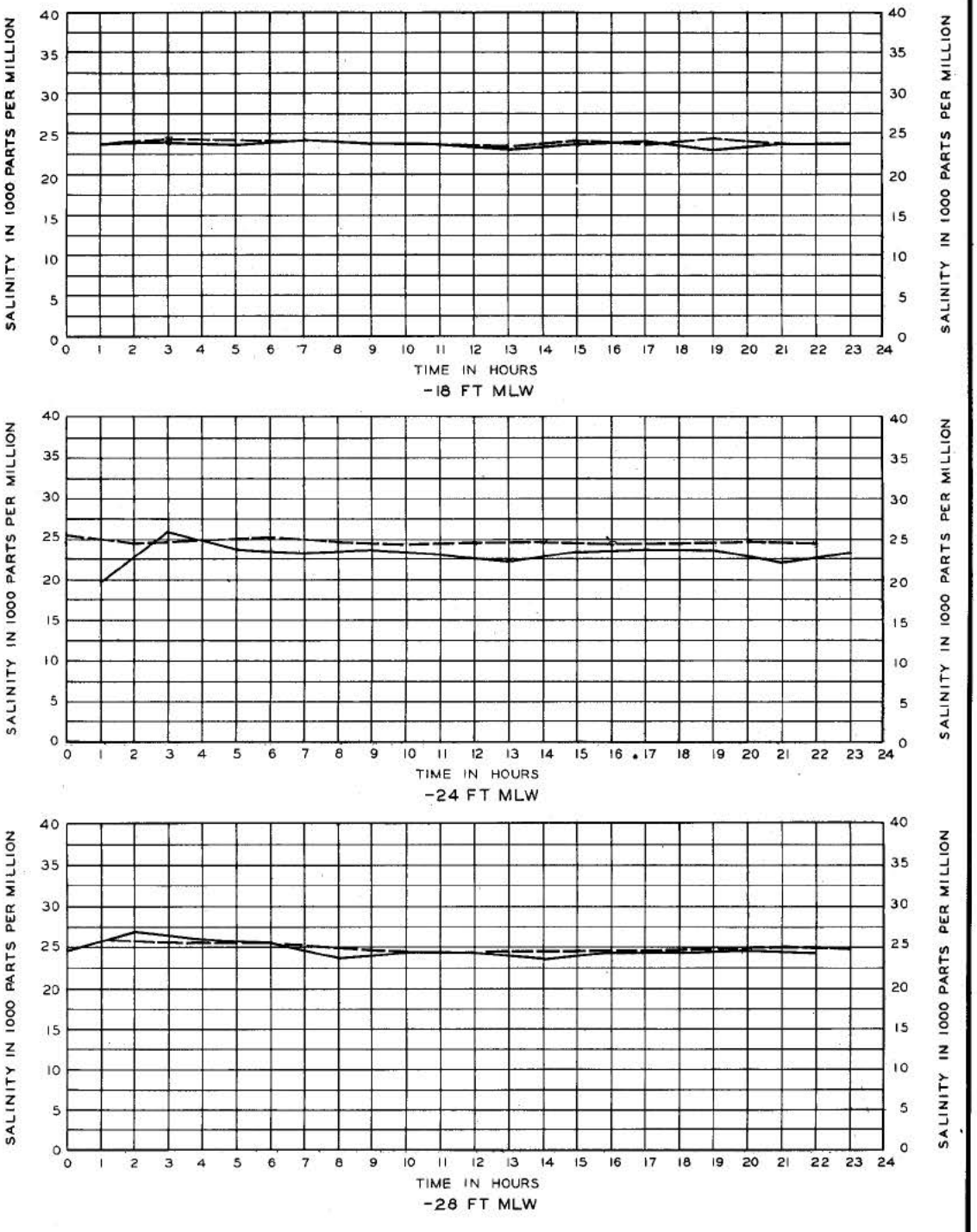
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-500 CFS
TESTS 4 AND 13



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

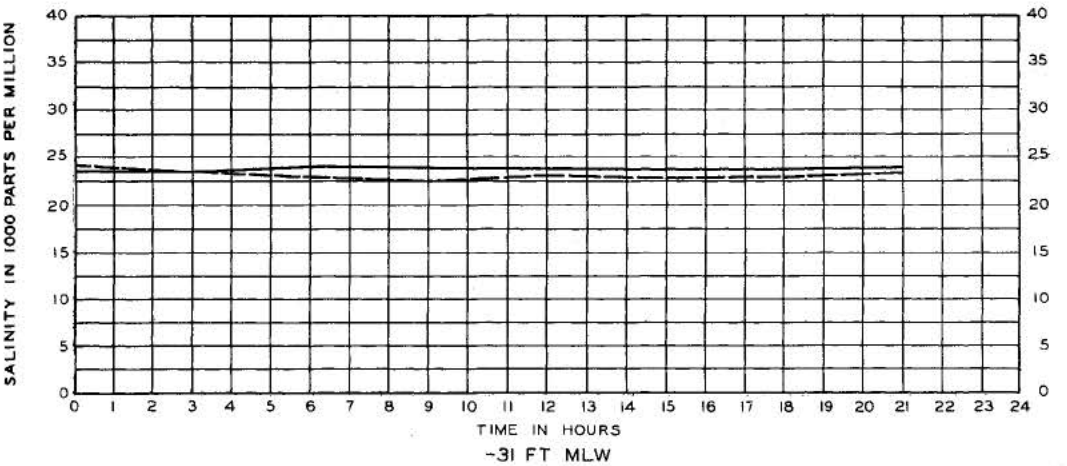
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

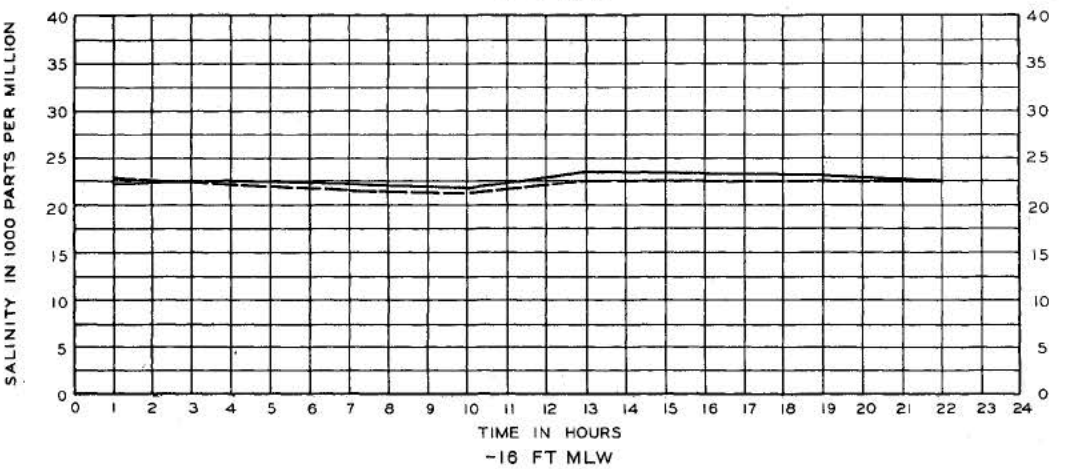
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

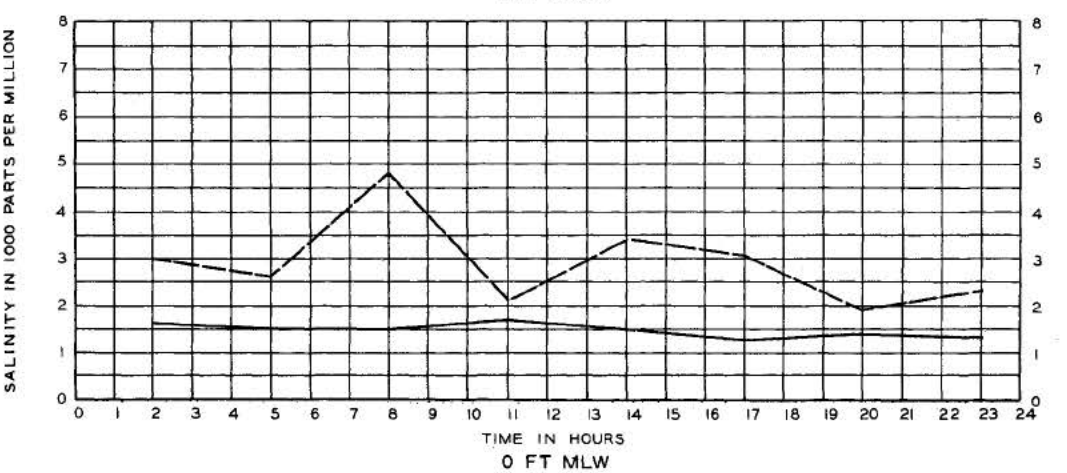
SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TESTS 4 AND 13

PLATE 34







LEGEND

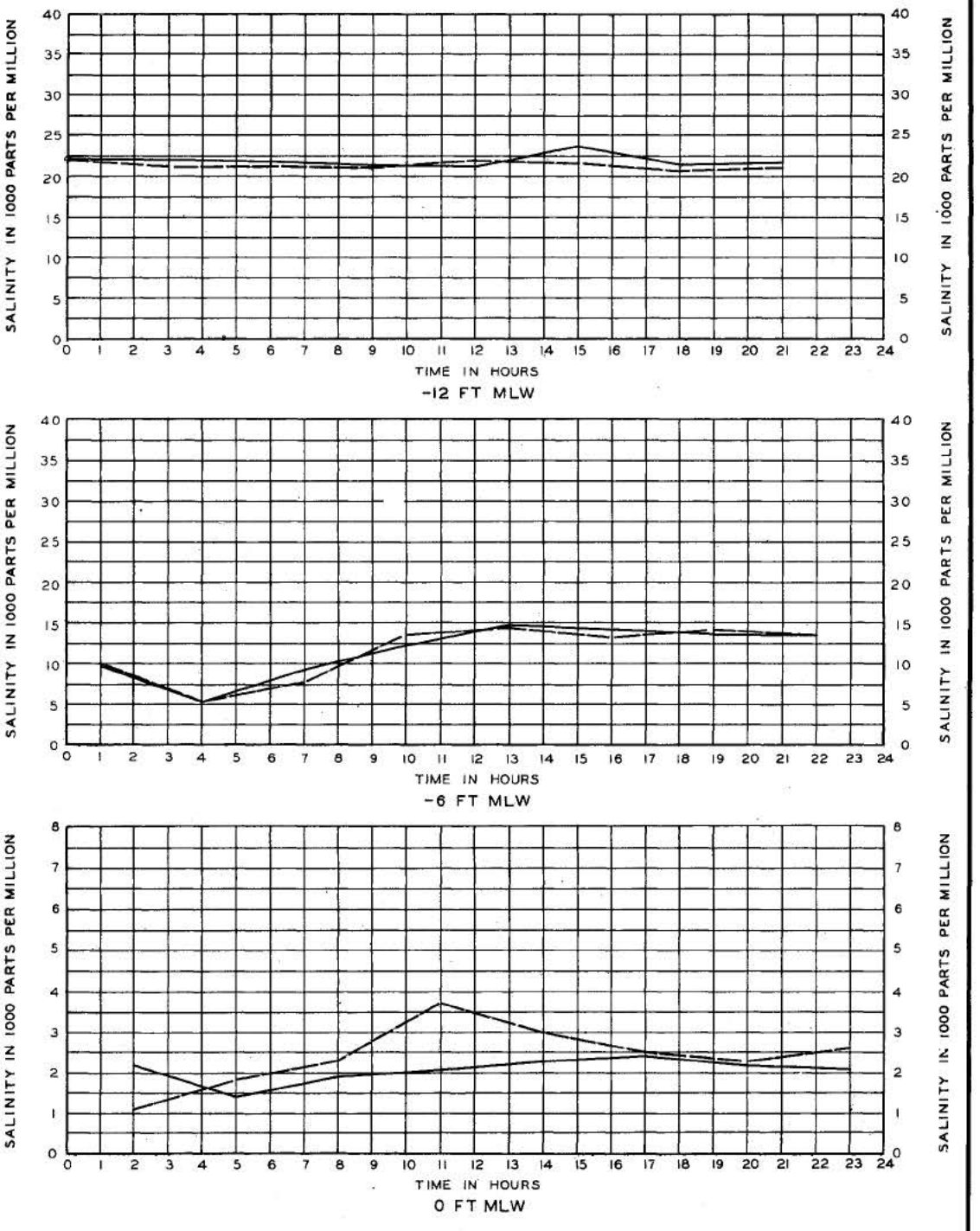
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH

SALINITY AT STATION 3

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-500 CFS
TESTS 4 AND 13

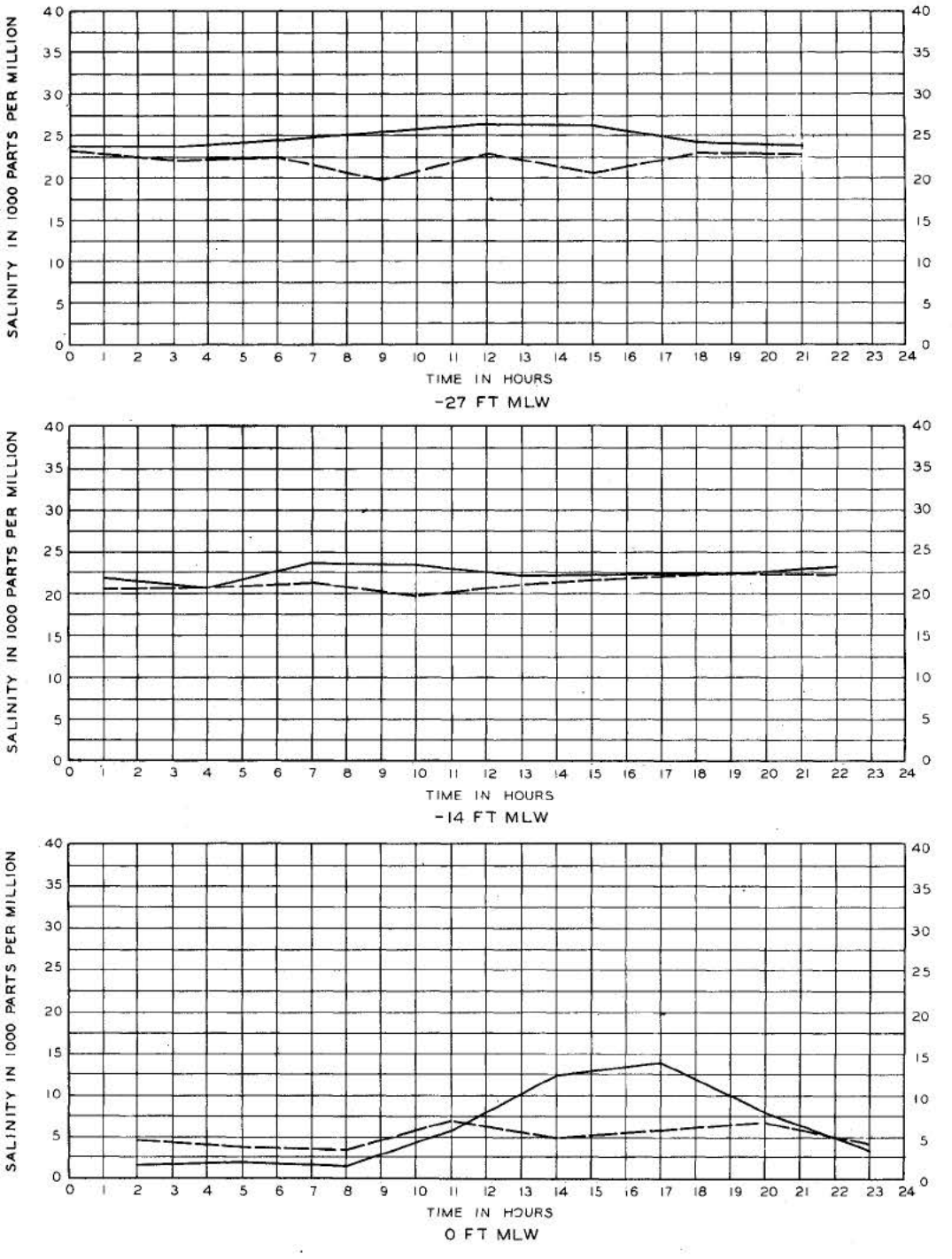


NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH

SALINITY AT STATION 5

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-500 CFS
TESTS 4 AND 13

PLATE 36



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

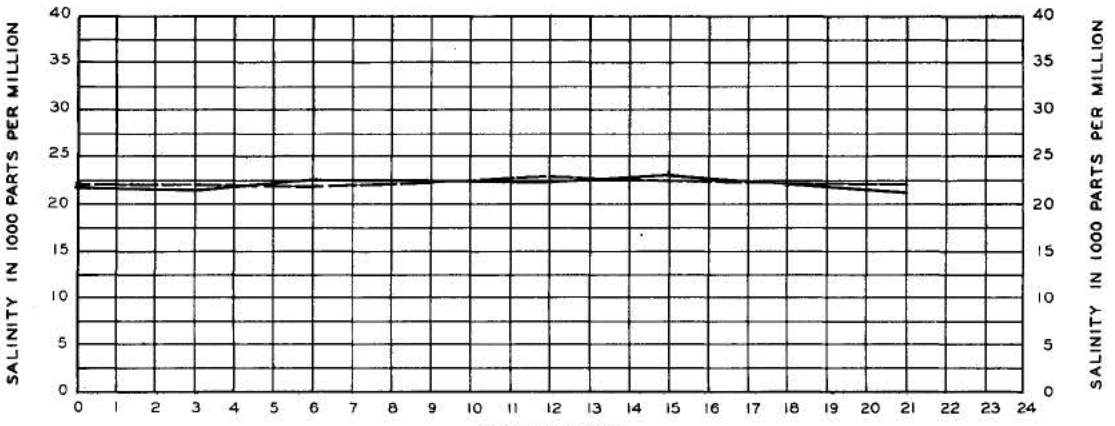
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

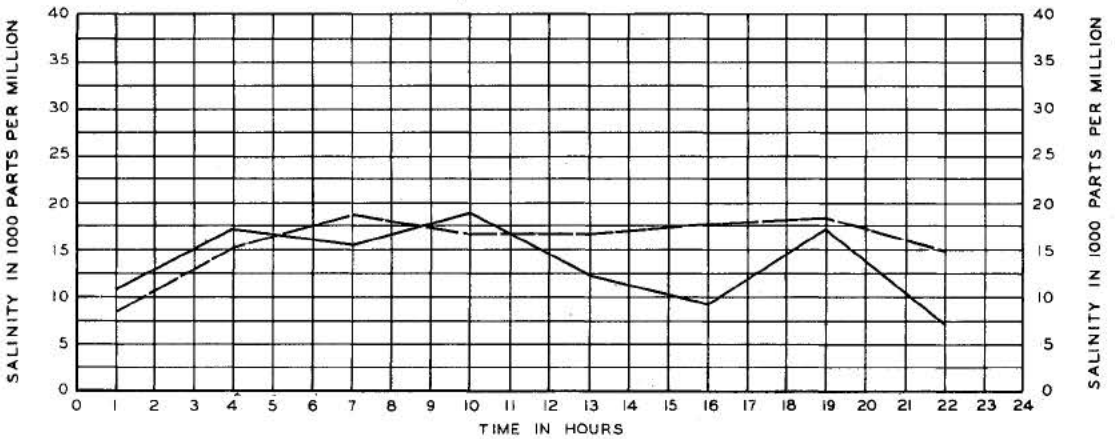
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

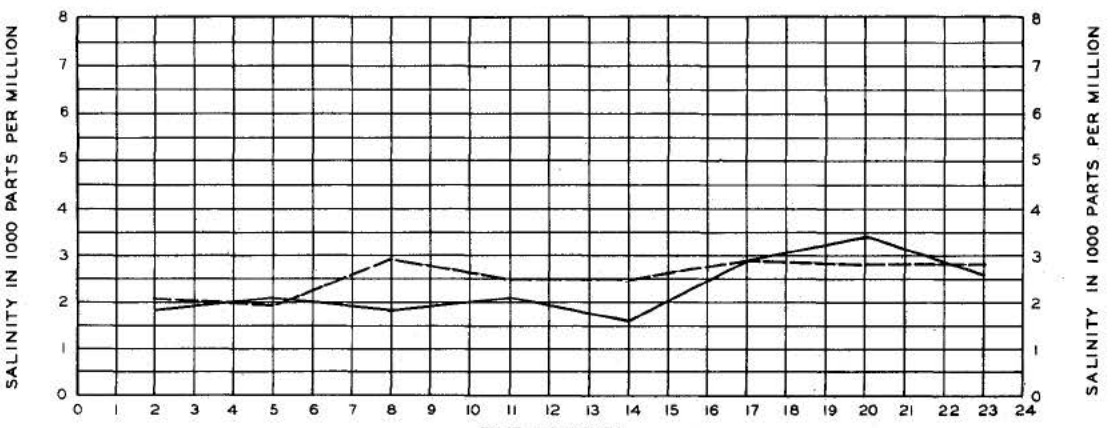
SALINITY AT STATION 6

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-500 CFS
TESTS 4 AND 13

PLATE 37







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

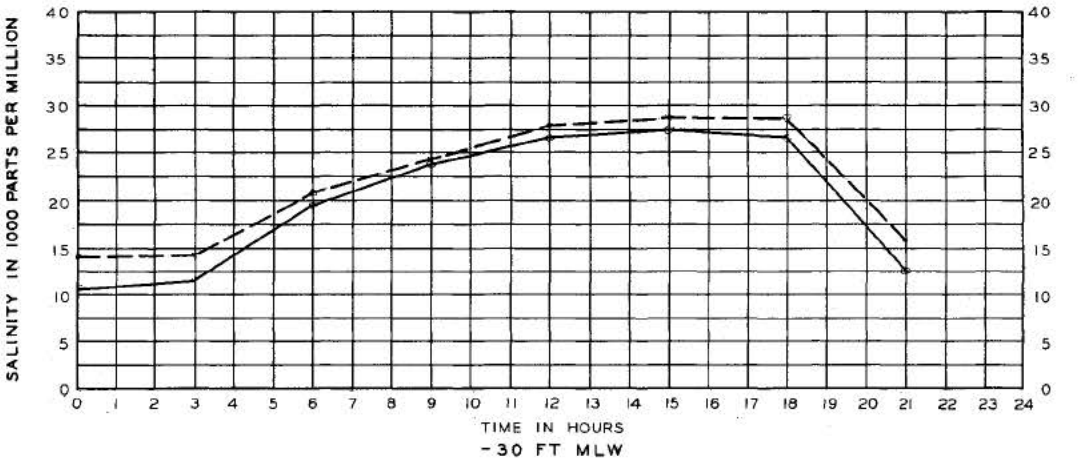
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

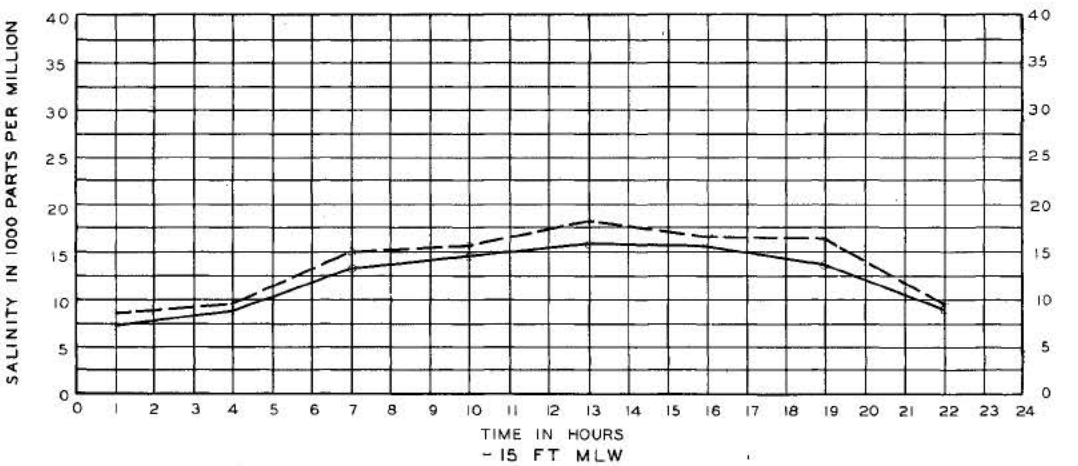
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

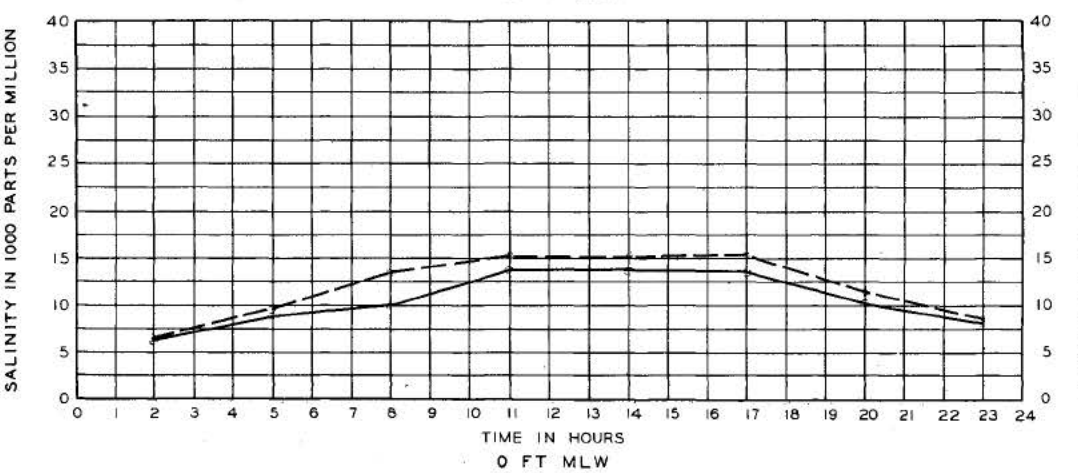
SALINITY AT STATION 7

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-500 CFS
TESTS 4 AND 13

PLATE 38







LEGEND

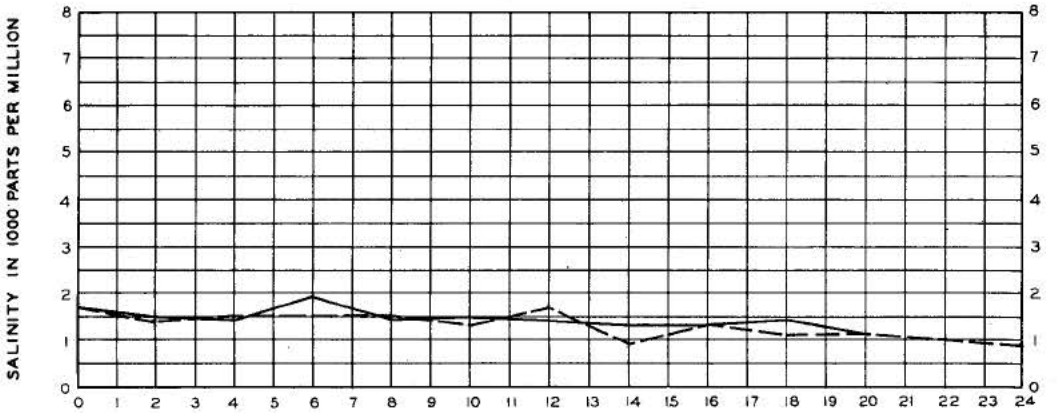
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

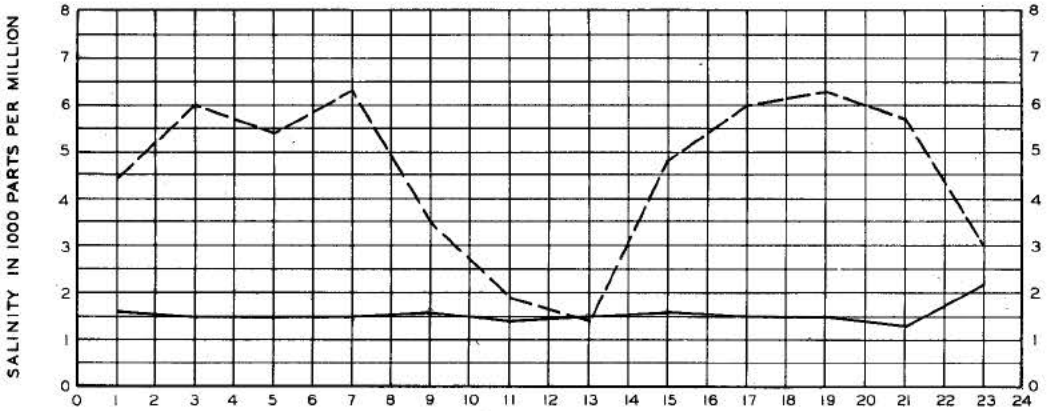
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

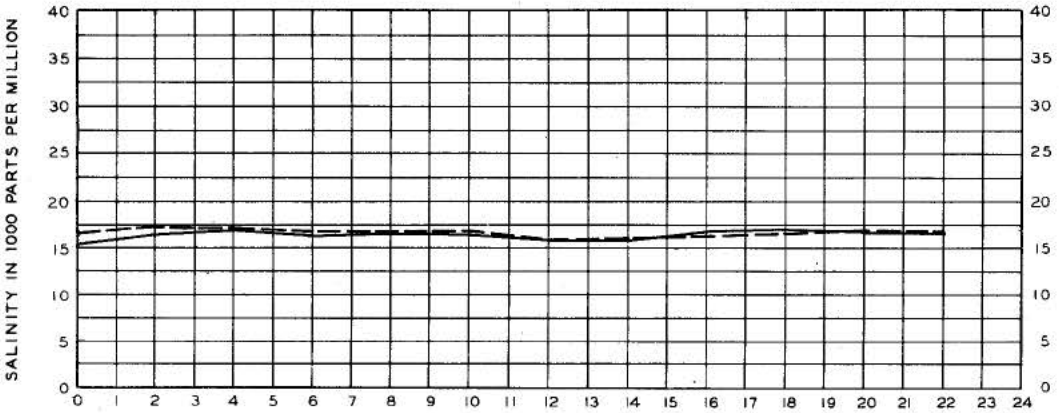
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 1

EAST FLOW IN INTRACOASTAL WATERWAY – 1000 CFS
CALCASIEU RIVER DISCHARGE – 5000 CFS
TEST 5 AND 14







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

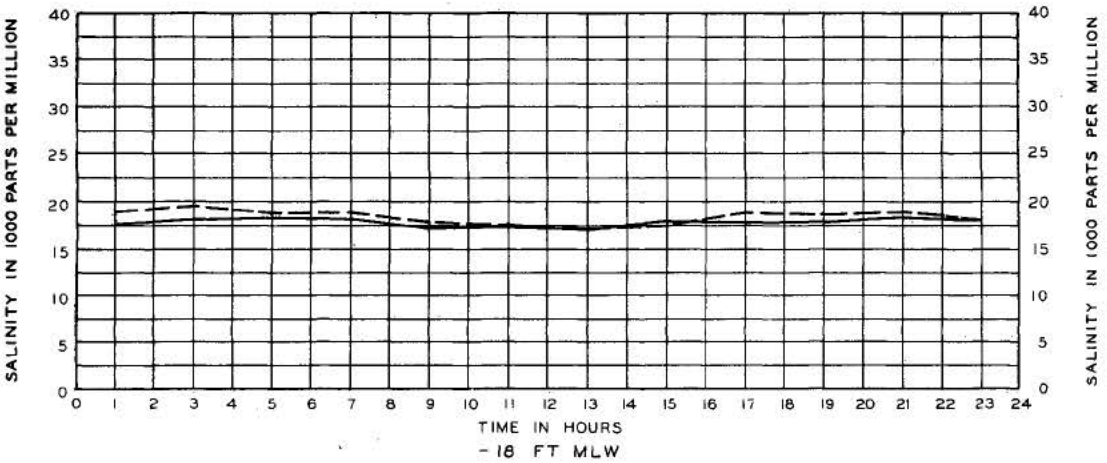
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

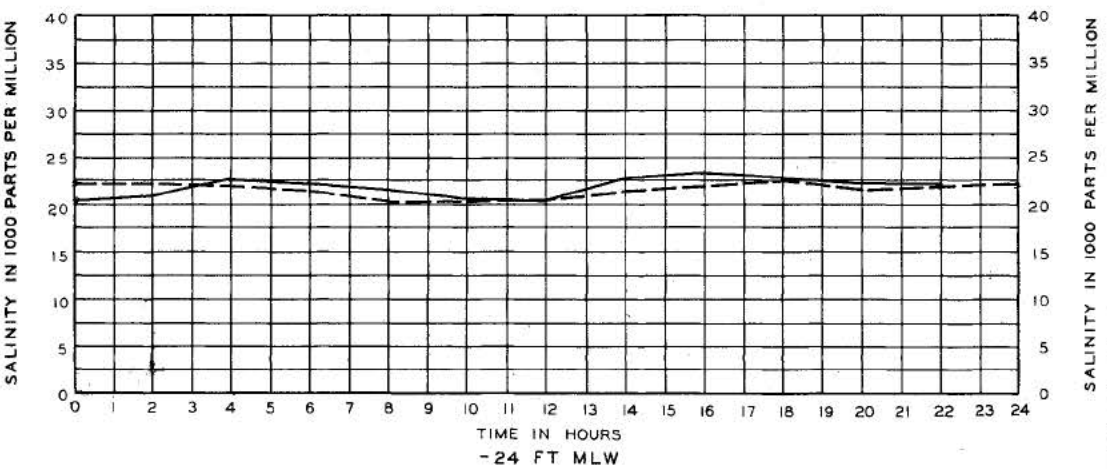
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

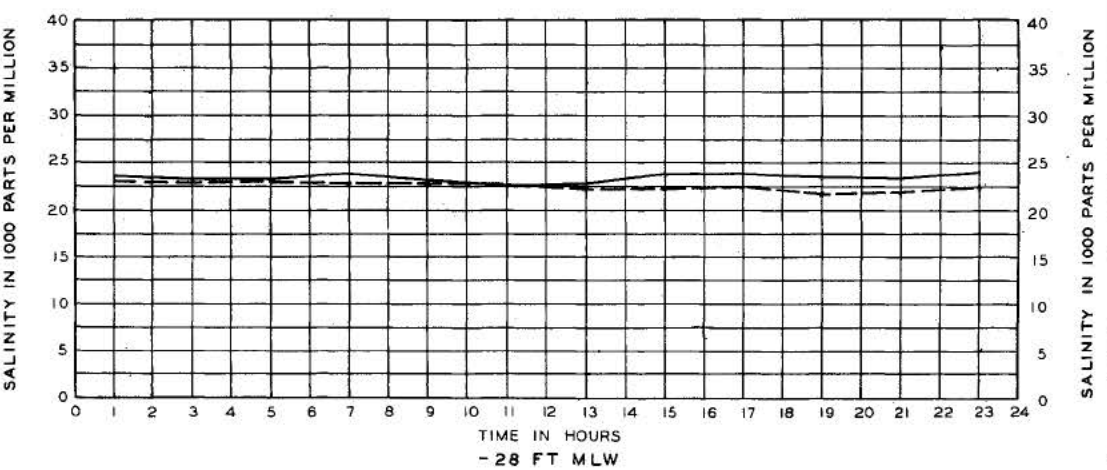
SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS
CALCASIEU RIVER DISCHARGE - 5000 CFS
TEST 5 AND 14

PLATE 40







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

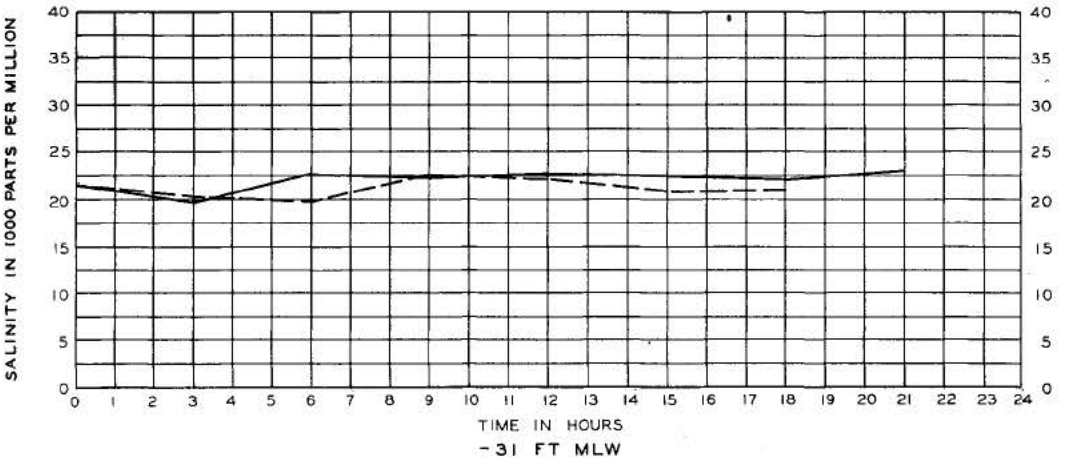
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

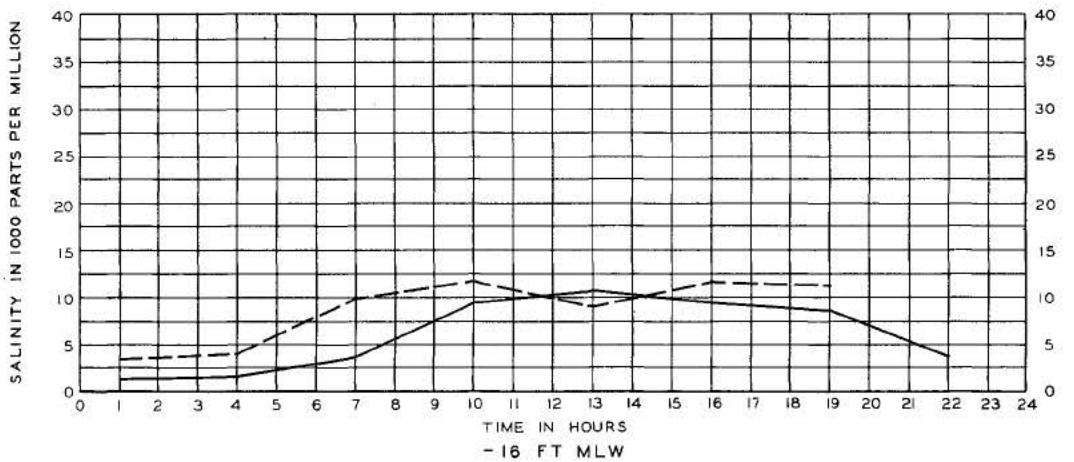
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

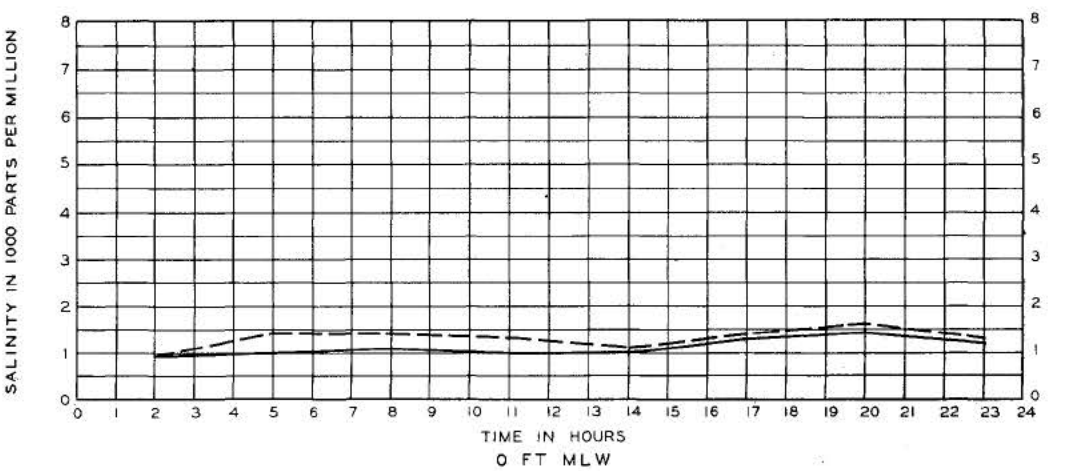
SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS
CALCASIEU RIVER DISCHARGE -5000 CFS
TEST 5 AND 14

PLATE 41







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

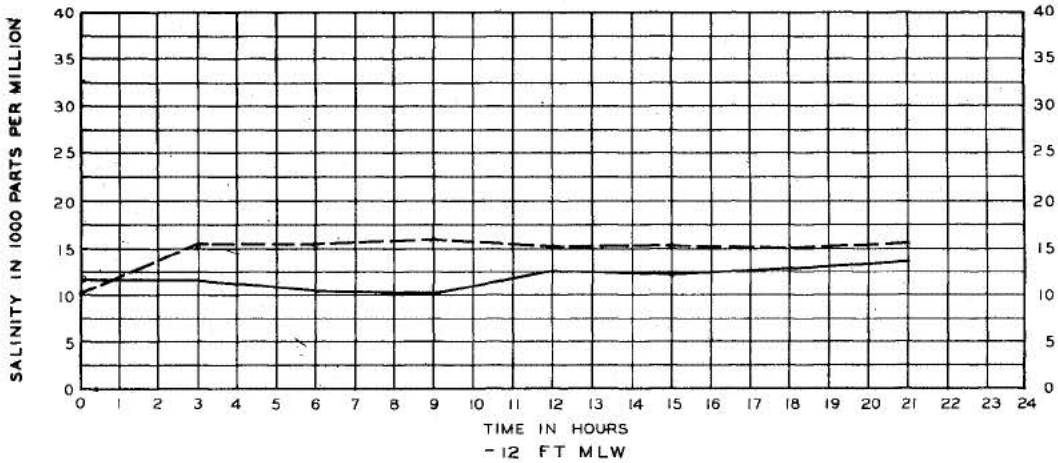
SALINITY AT STATION 3

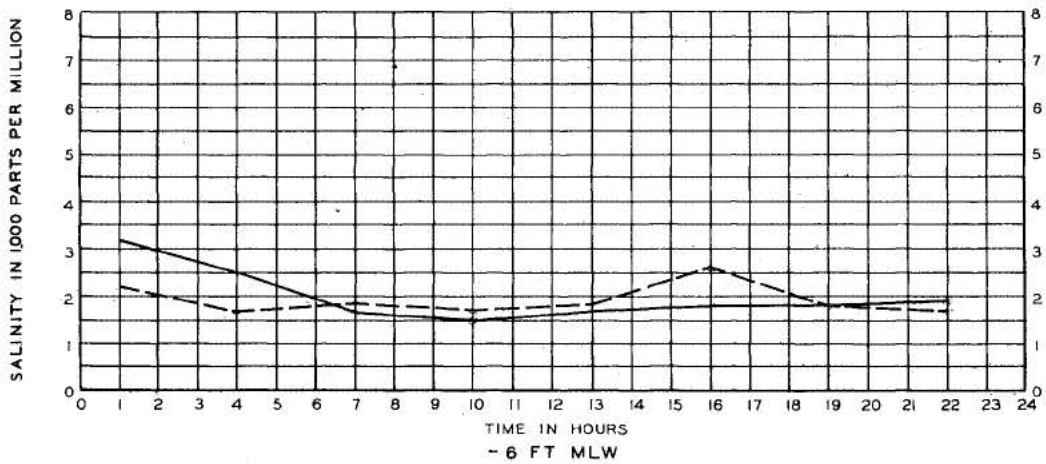
EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS

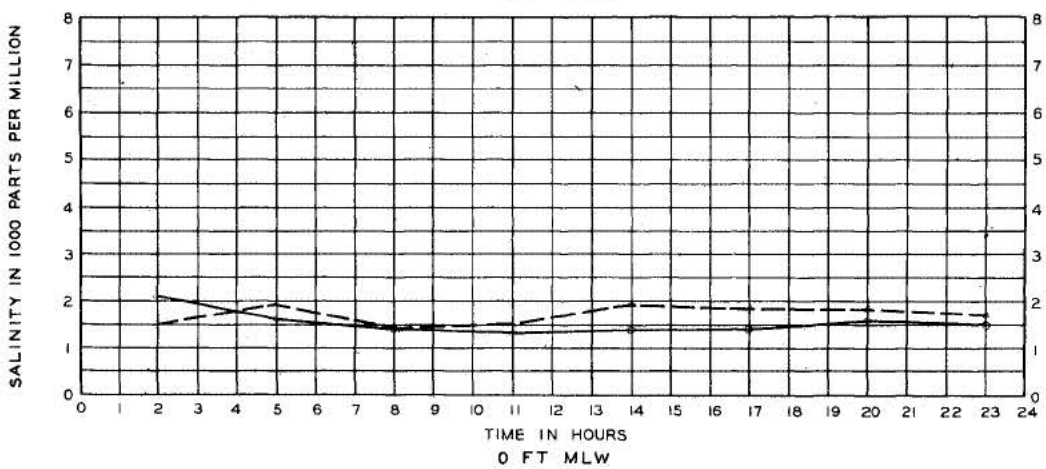
CALCASIEU RIVER DISCHARGE - 5000 CFS

TEST 5 AND 14

PLATE 42







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPT.

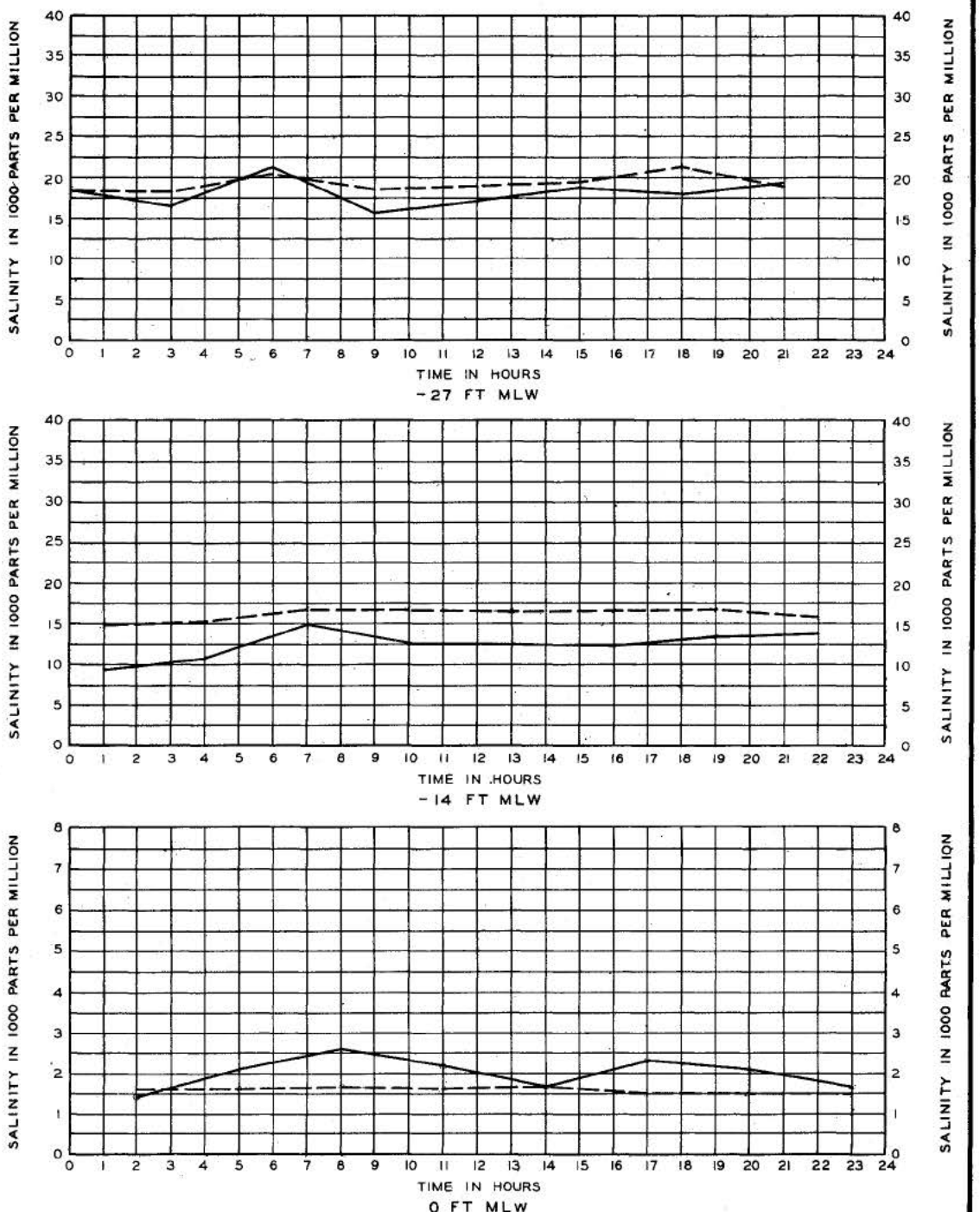
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH

SALINITY AT STATION 5

EAST FLOW IN INTRACOASTAL WATERWAY – 1000 CFS
CALCASIEU RIVER DISCHARGE – 5000 CFS
TEST 5 AND 14

PLATE 43



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.

SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

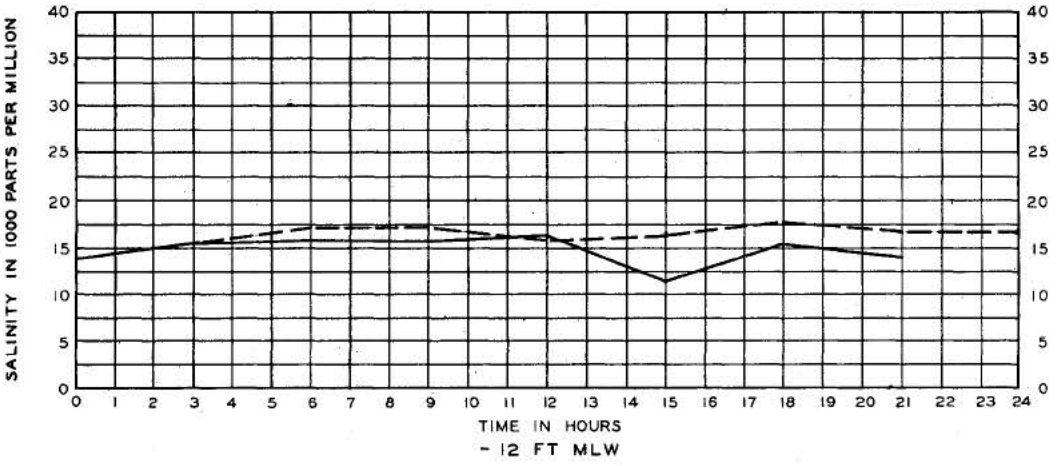
SALINITY AT STATION 6

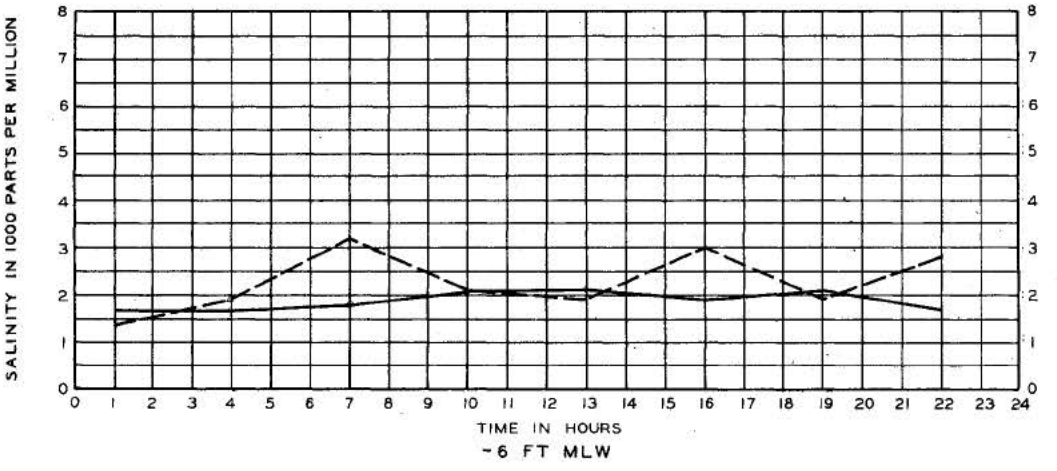
EAST FLOW IN INTRACOASTAL WATERWAY – 1000 CFS

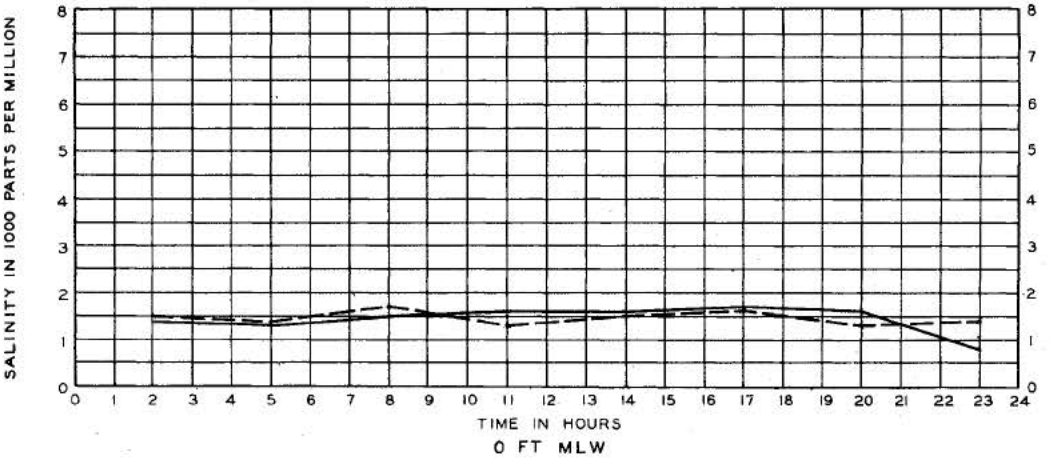
CALCASIEU RIVER DISCHARGE – 5000 CFS

TEST 5 AND 14

PLATE 44







LEGEND

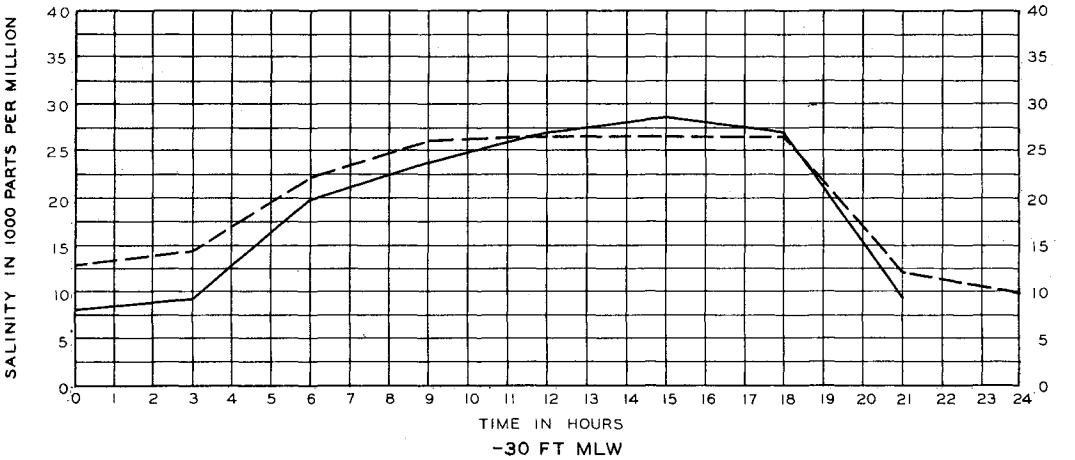
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

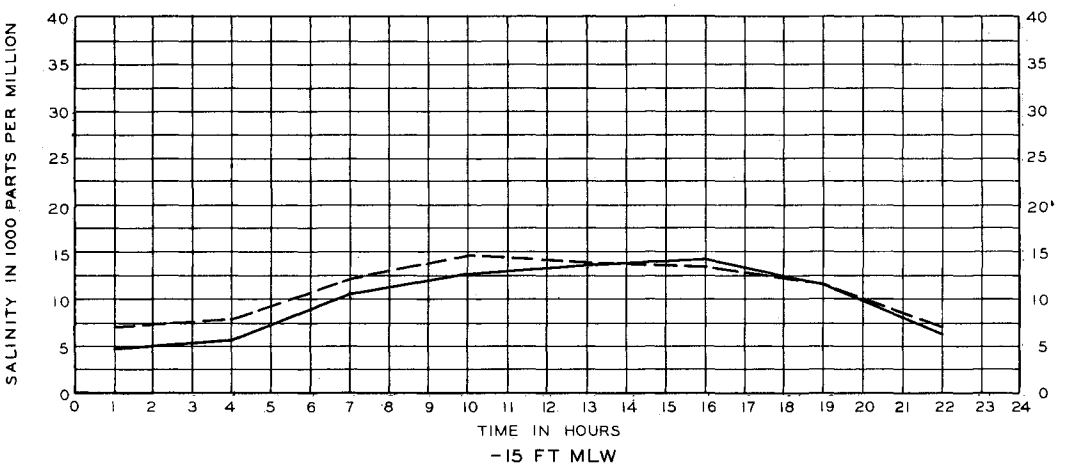
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

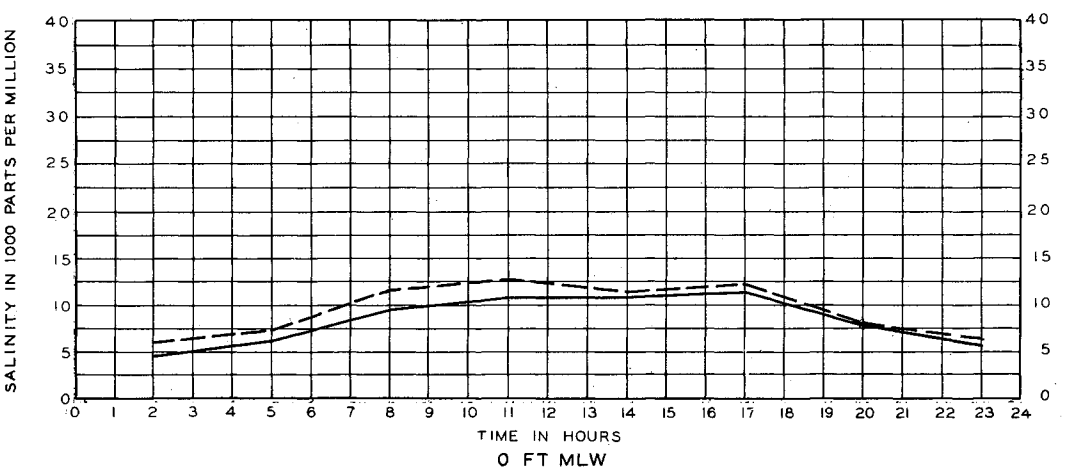
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 7

EAST FLOW IN INTRACOASTAL WATERWAY - 1000 CFS
CALCASIEU RIVER DISCHARGE - 5000 CFS
TEST 5 AND 14







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

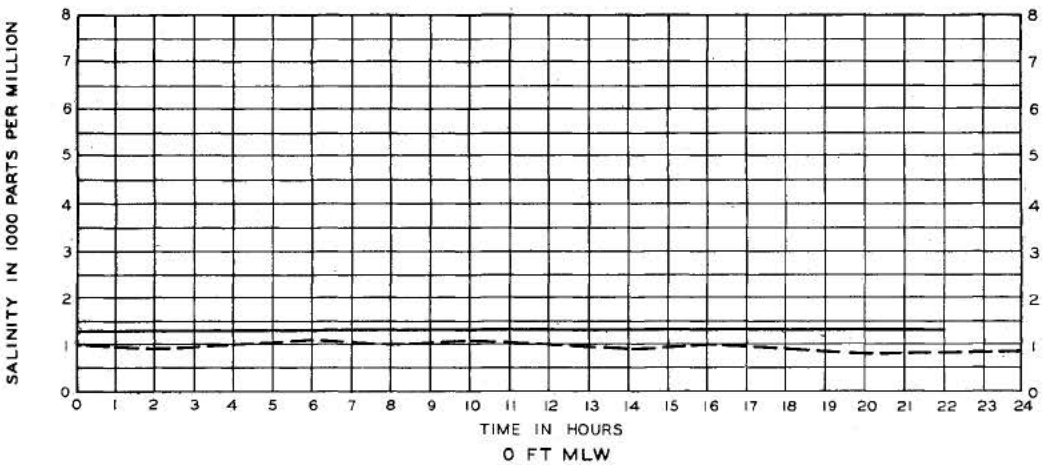
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

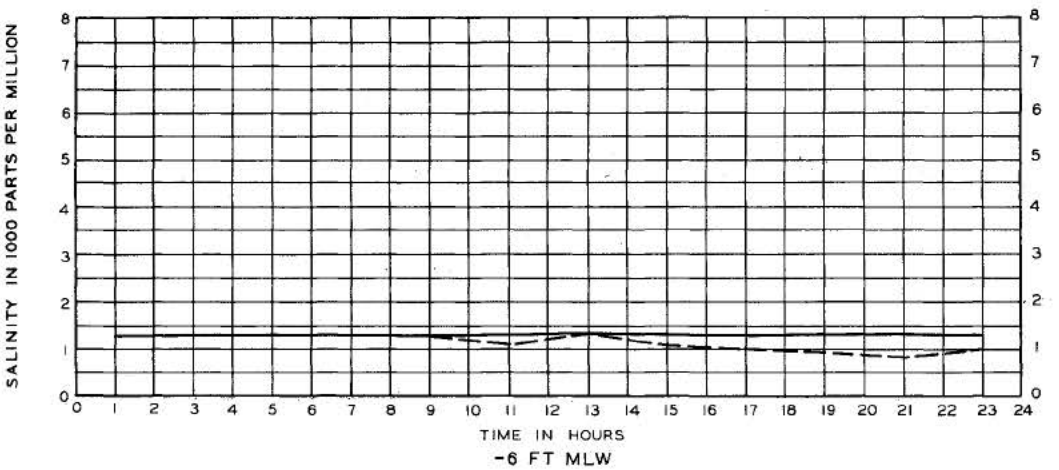
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

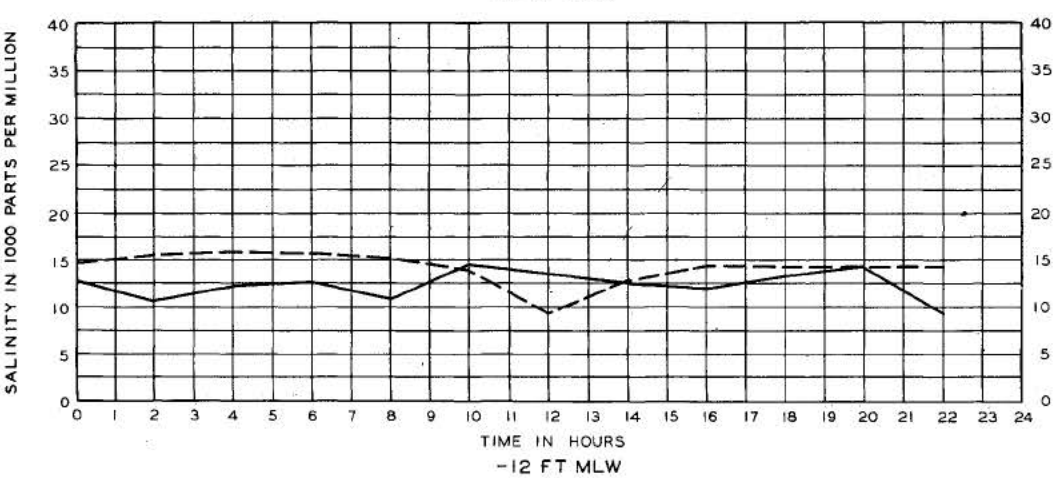
SALINITY AT STATION 1

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-7000 CFS
TESTS 6 AND 15

PLATE 46







LEGEND

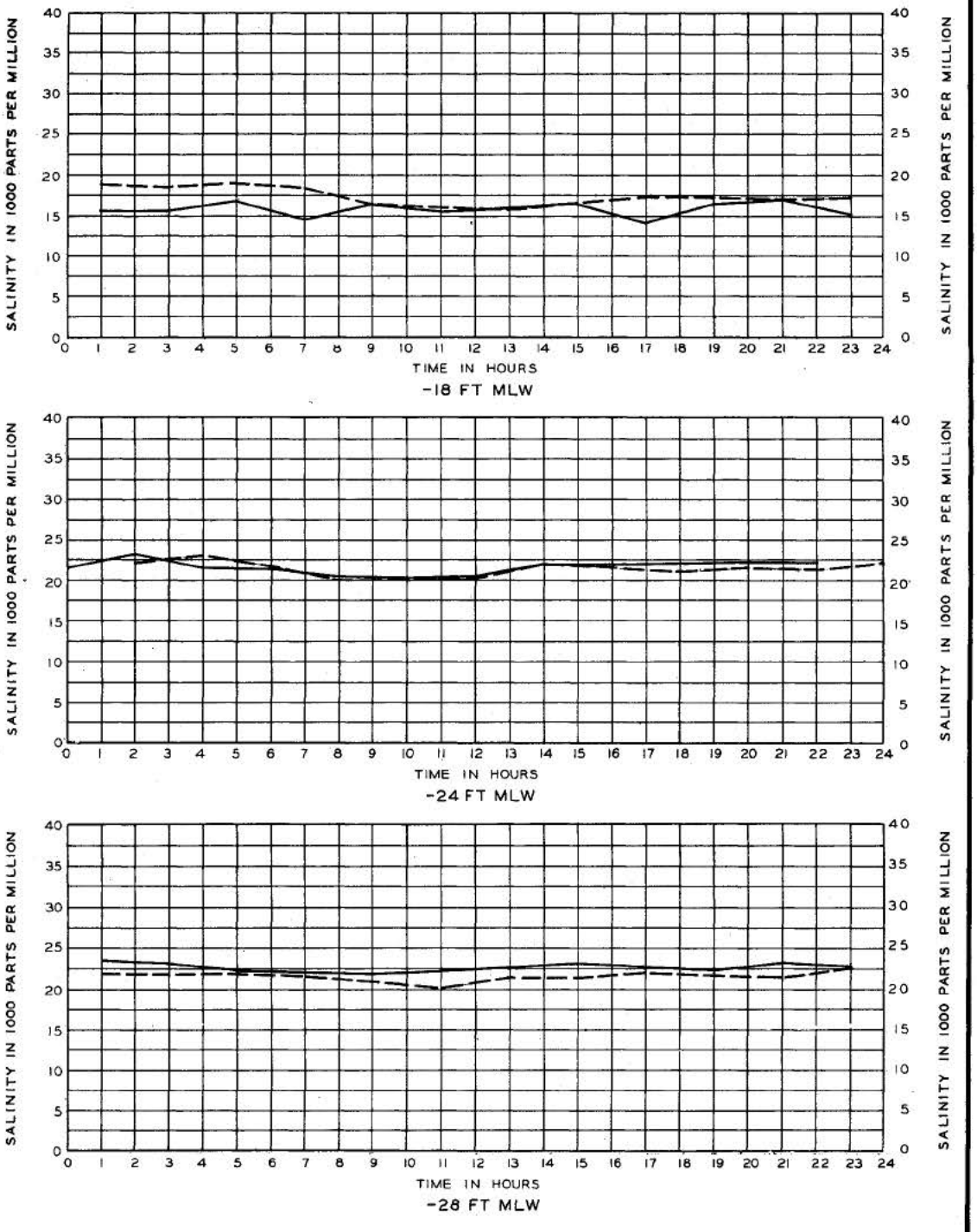
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 6 AND 15



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

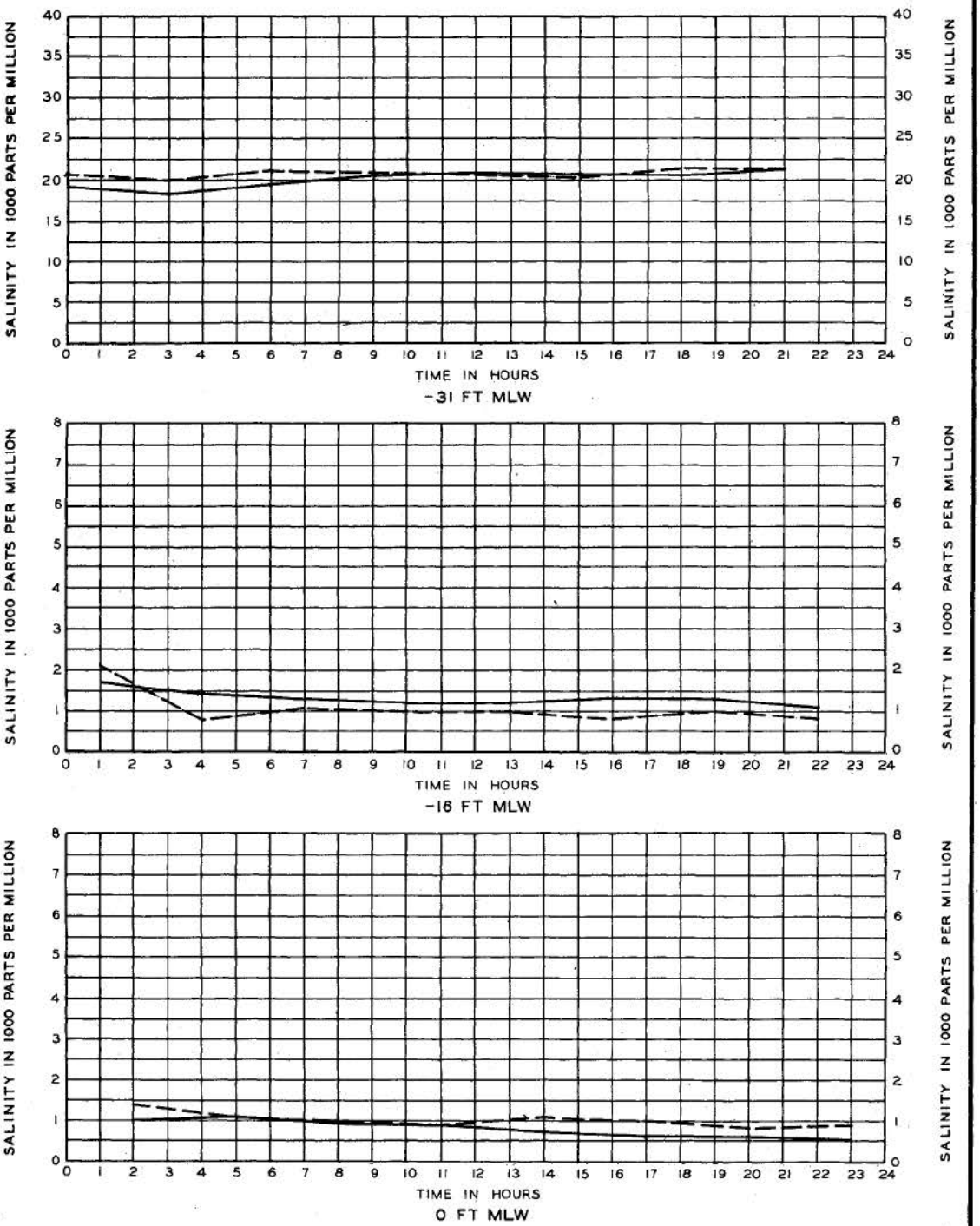
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE - 7000 CFS
TESTS 6 AND 15

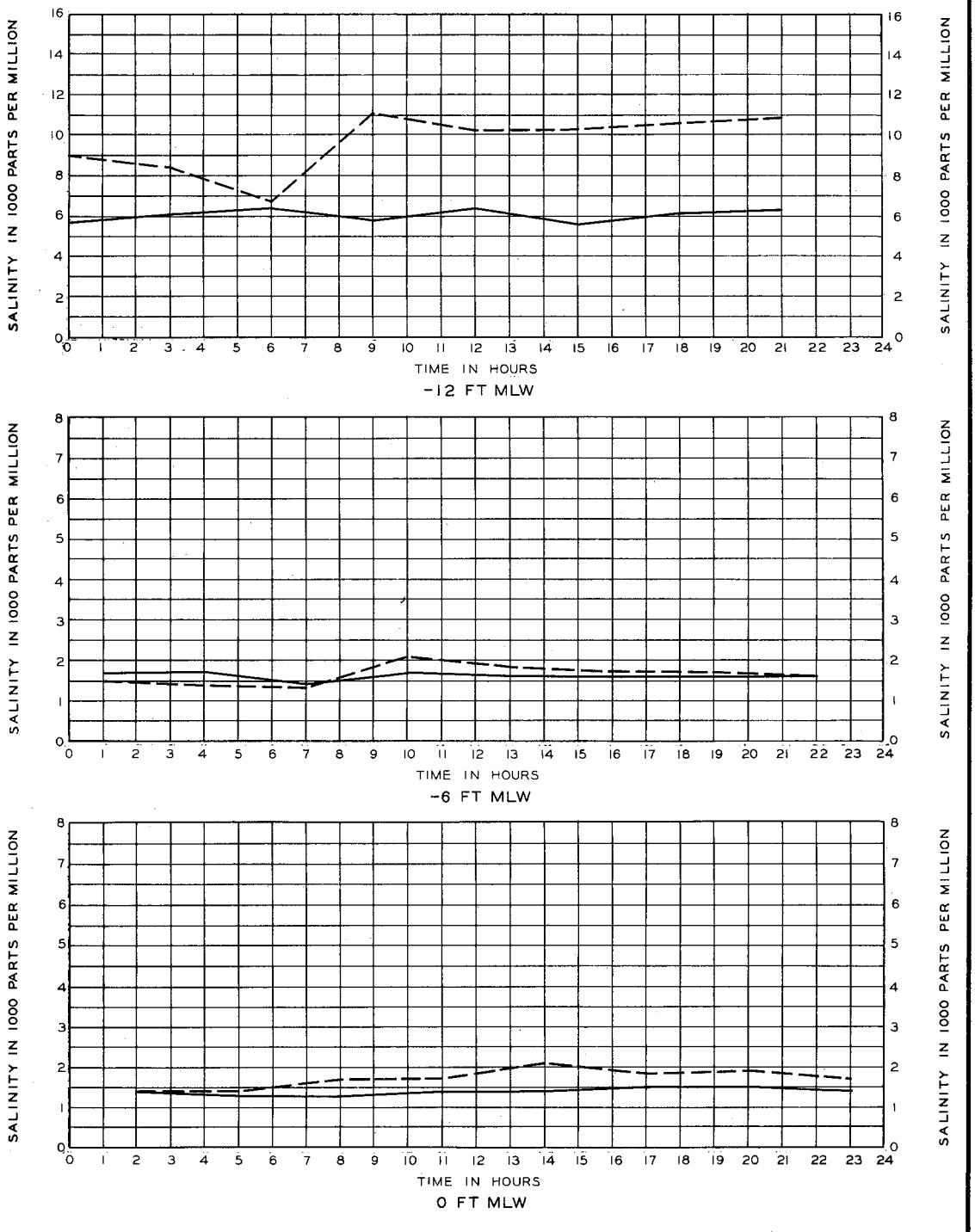
PLATE 48



NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 3

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-7000 CFS
TESTS 6 AND 15



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

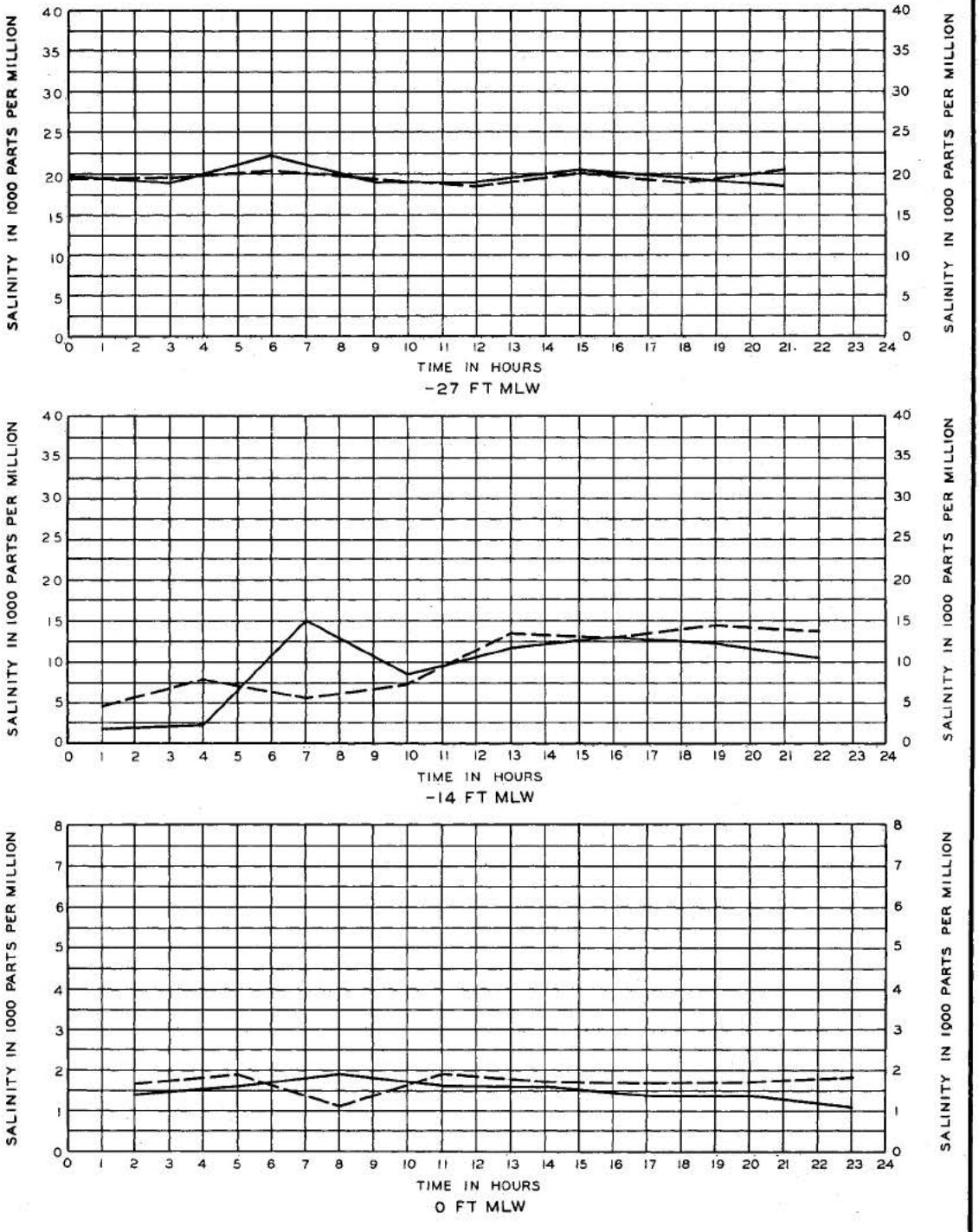
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 5

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-7000 CFS
TESTS 6 AND 15

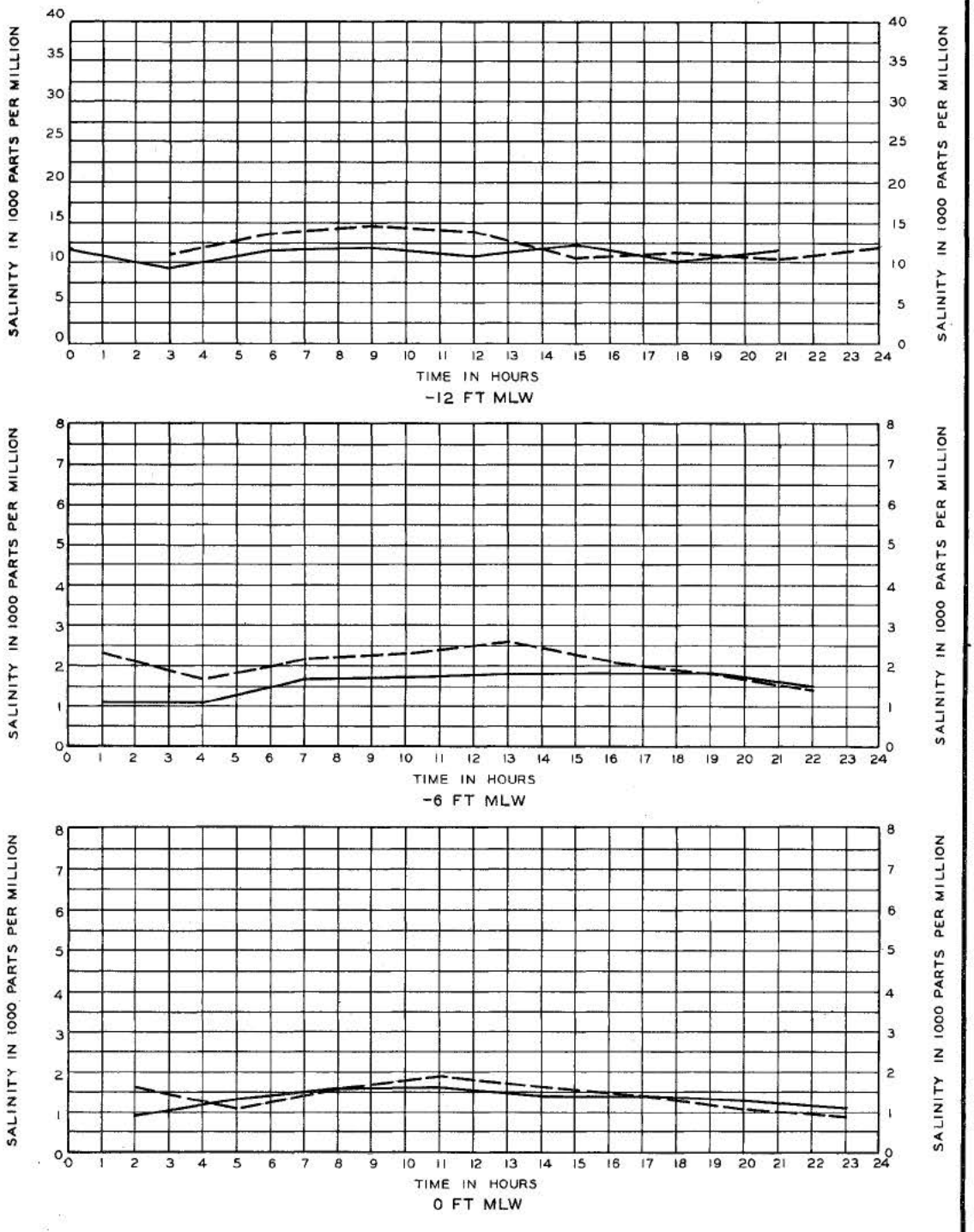
PLATE 50



NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 6

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-7000 CFS
TESTS 6 AND 15

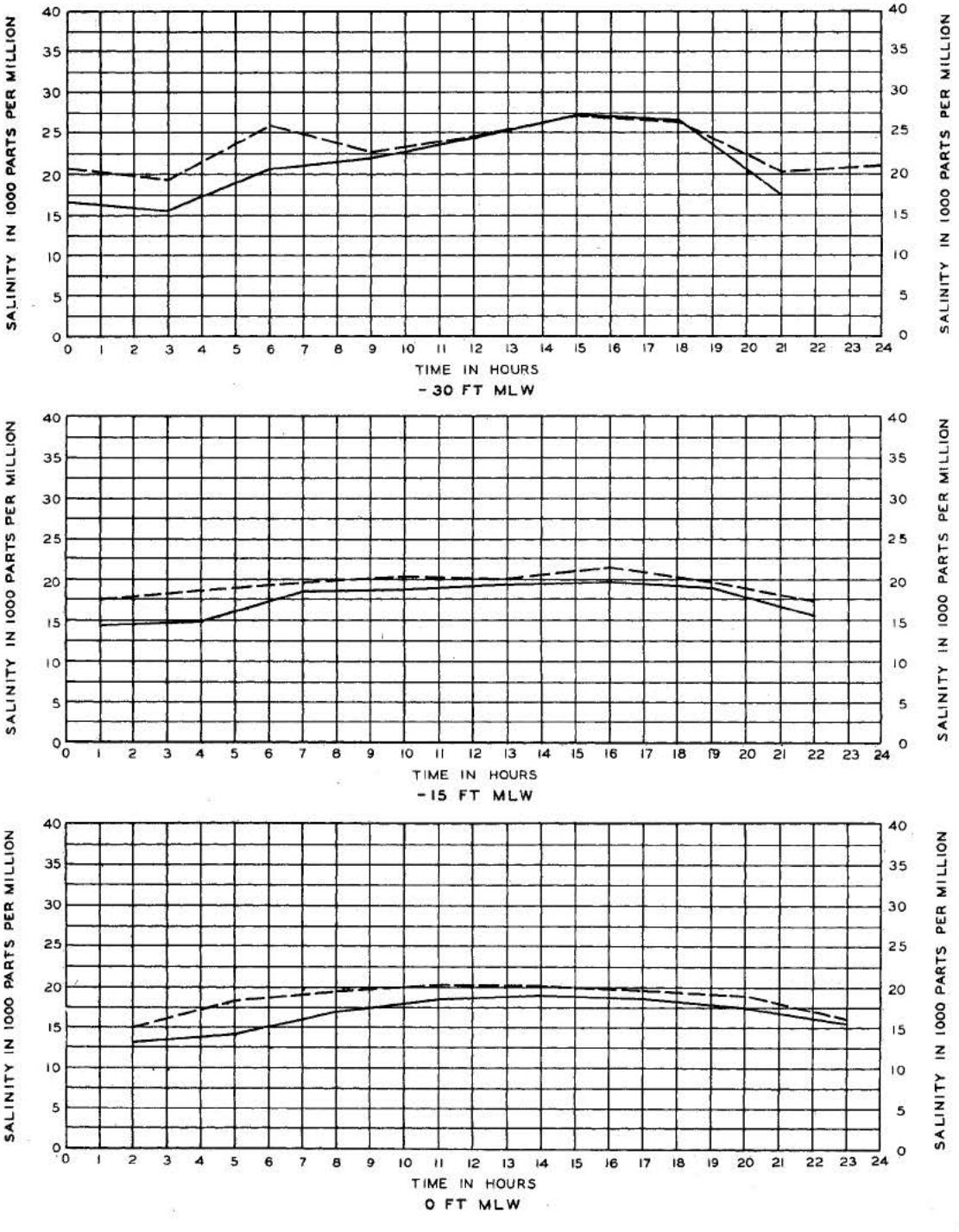


NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 7

EAST FLOW IN INTRACOASTAL WATERWAY-1000 CFS
CALCASIEU RIVER DISCHARGE-7000 CFS
TESTS 6 AND 15

PLATE 52



LEGEND

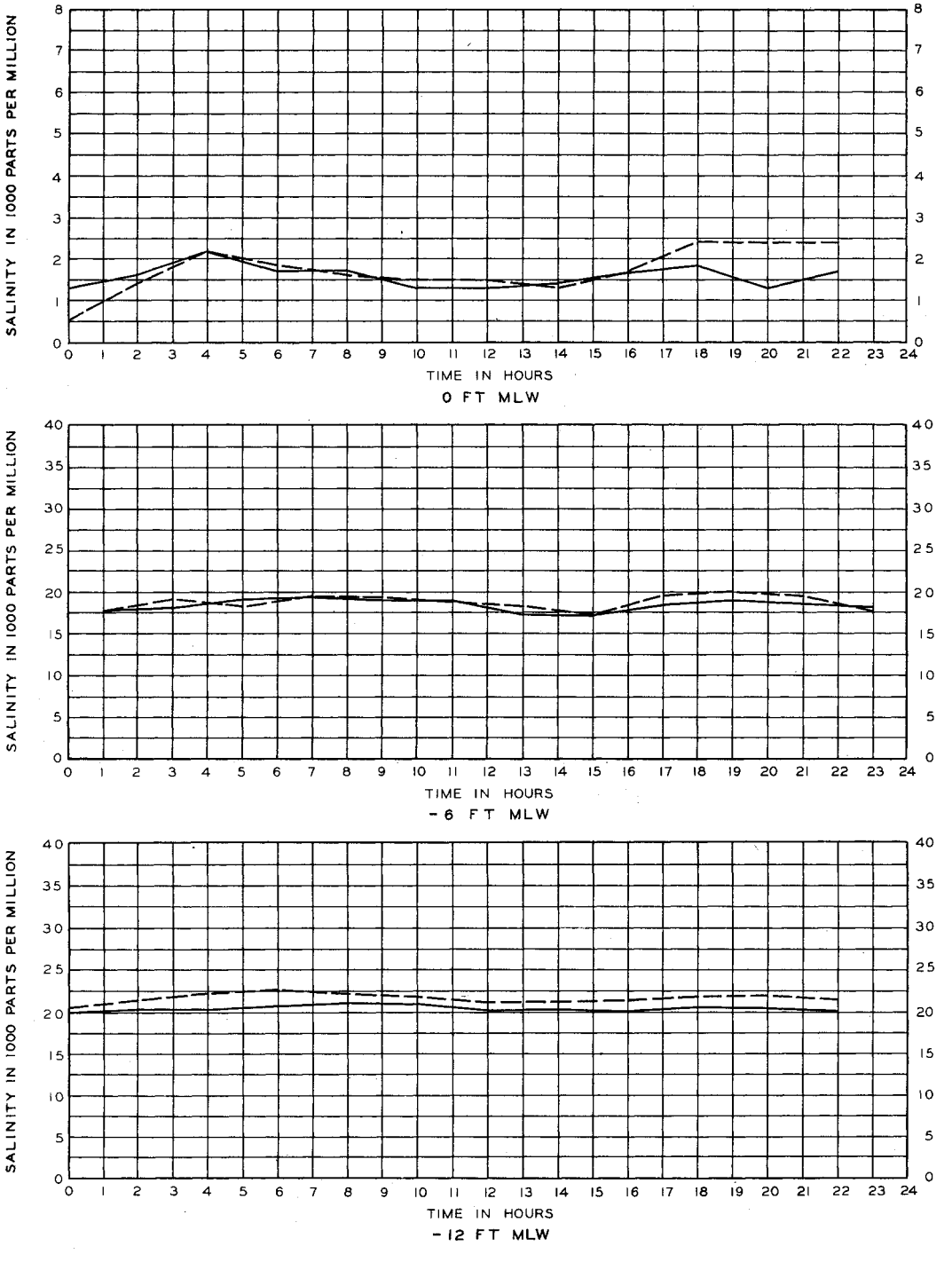
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 1

WEST FLOW IN INTRACOASTAL WATERWAY - 300 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 7 AND 16



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

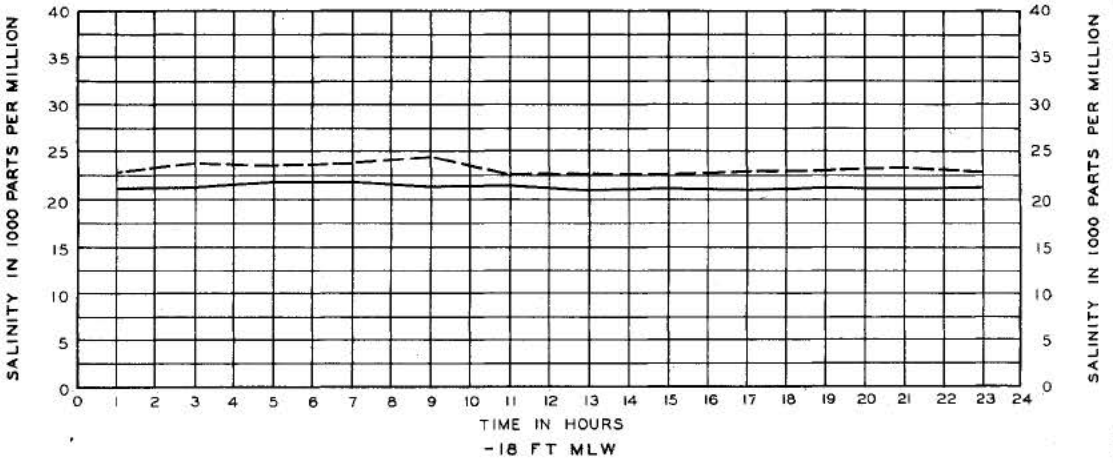
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

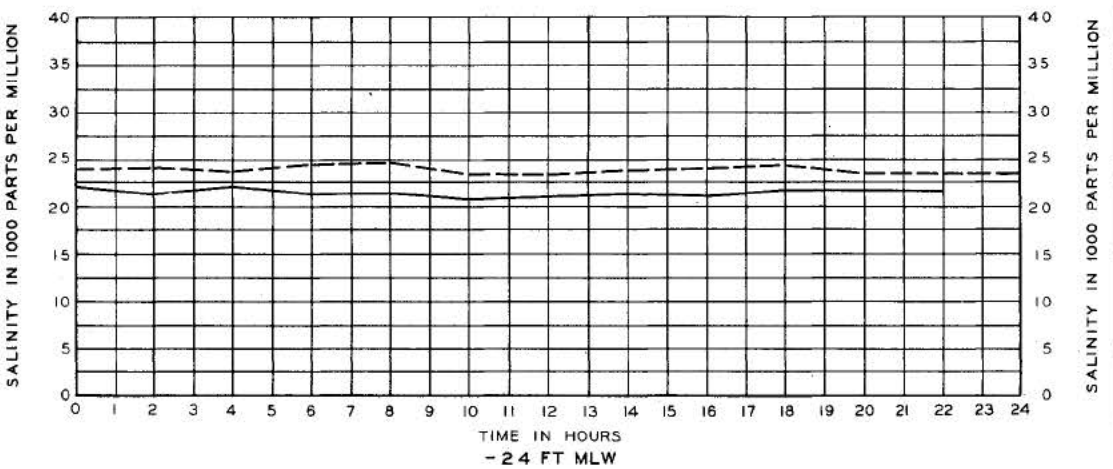
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

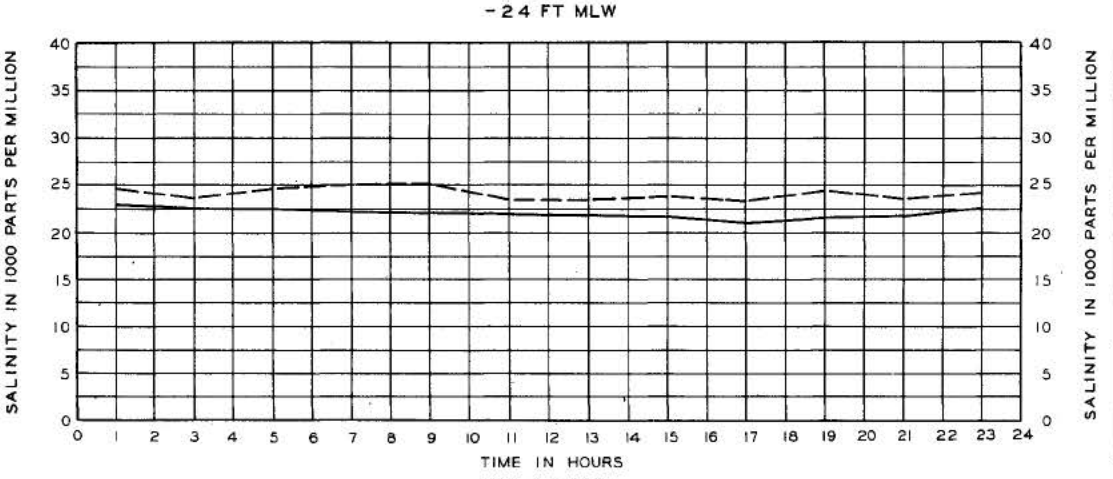
SALINITY AT STATION 2

WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 7 AND 16

PLATE 54







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

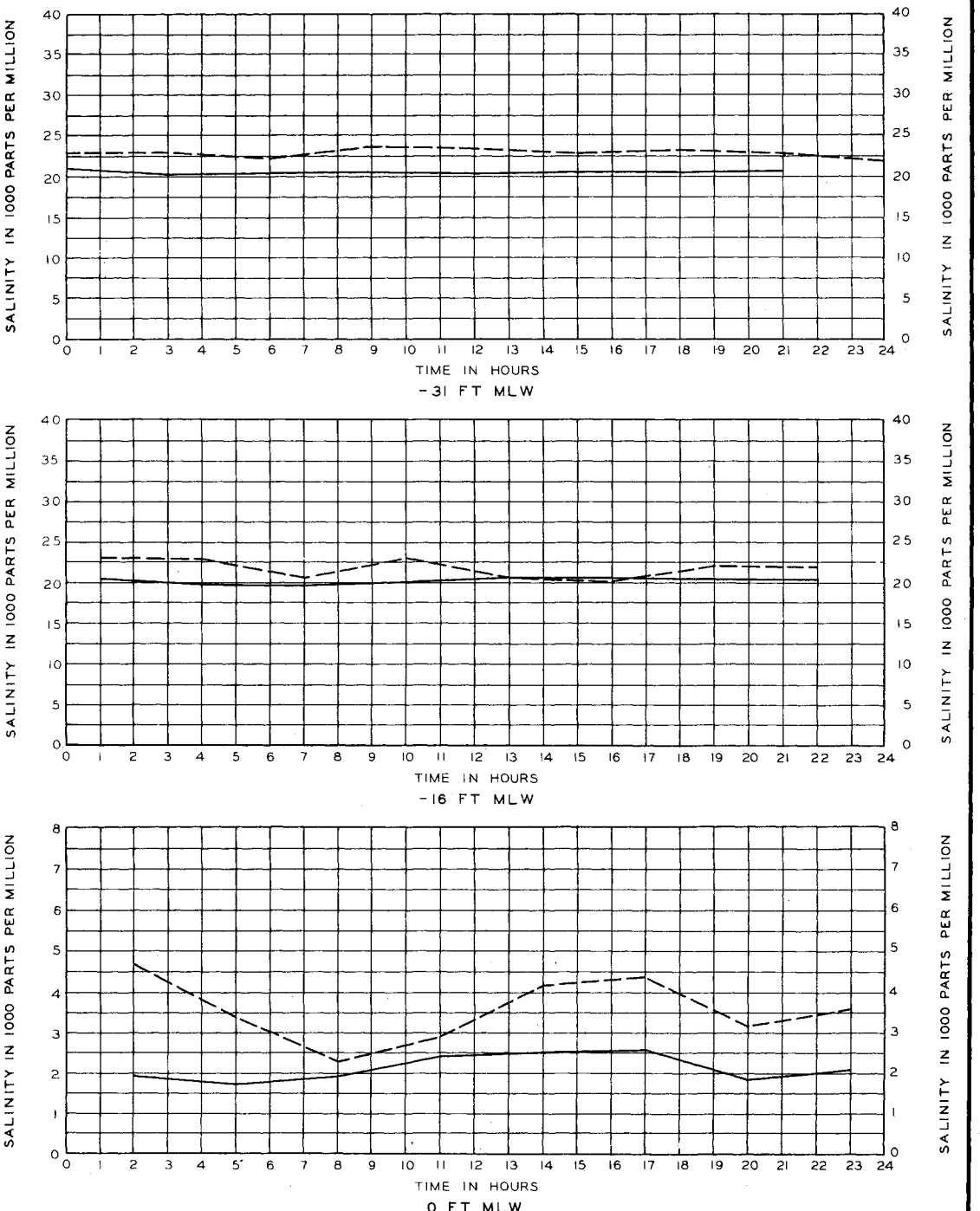
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS

CALCASIEU RIVER DISCHARGE – 500 CFS

TEST 7 AND 16

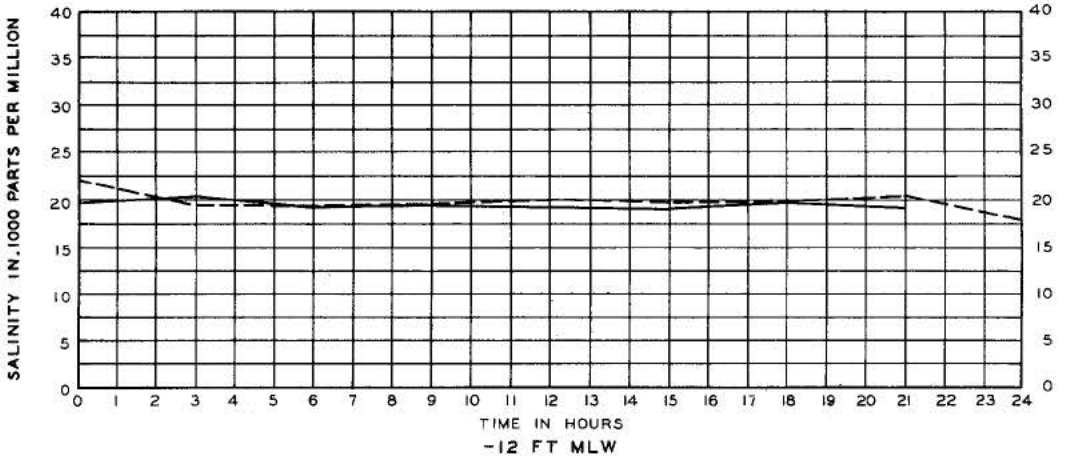


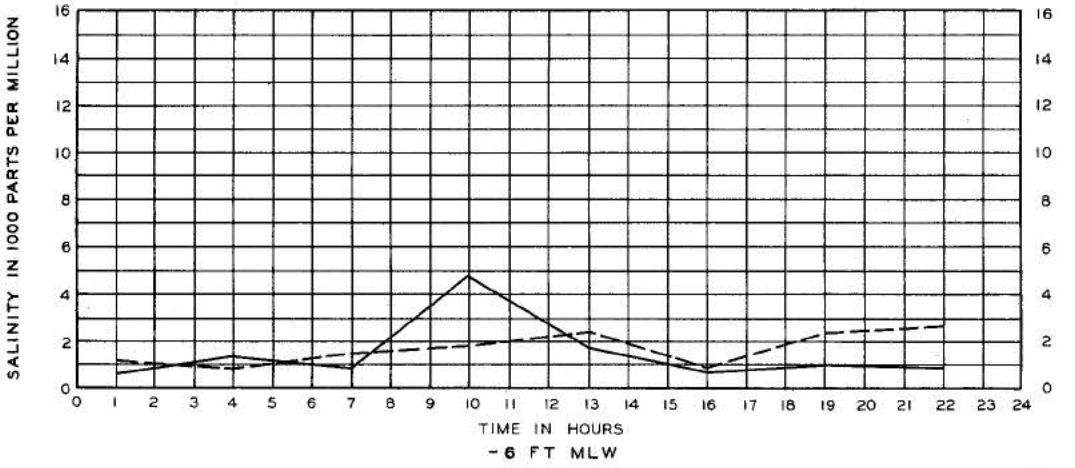
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

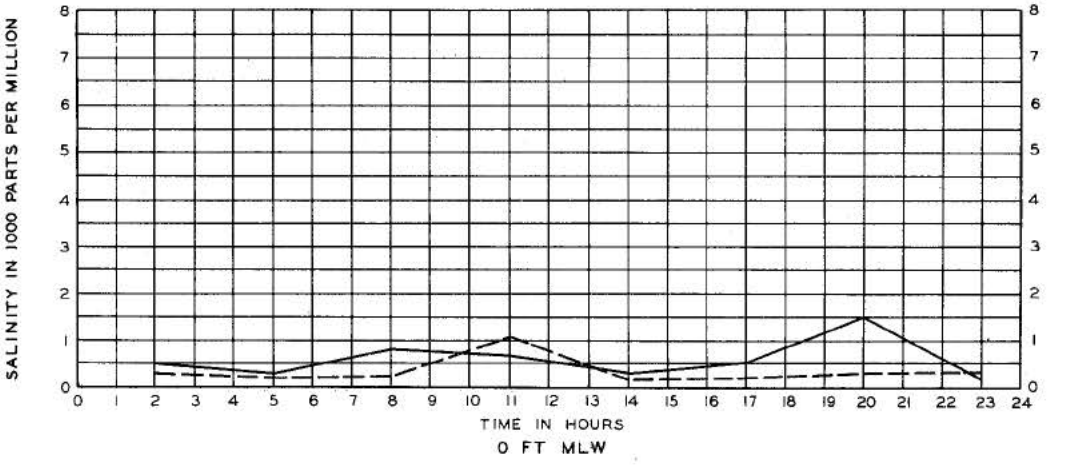
SALINITY AT STATION 3

WEST FLOW IN INTRACOASTAL WATERWAY - 300 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 7 AND 16

PLATE 56







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

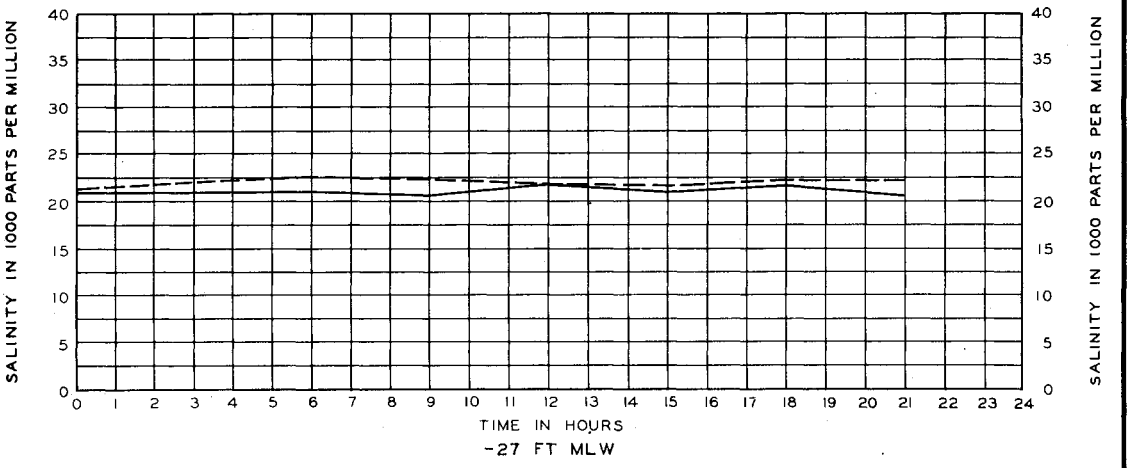
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

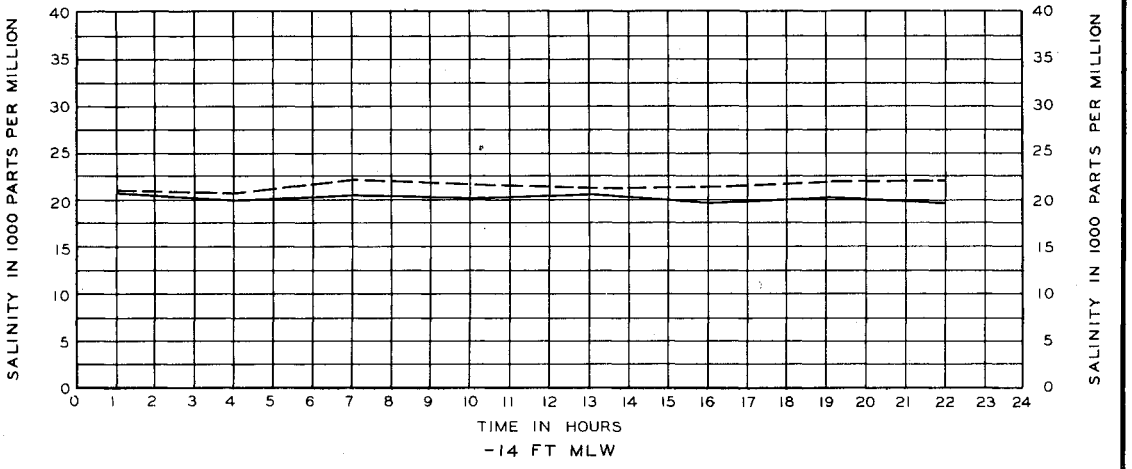
SALINITY AT STATION 5

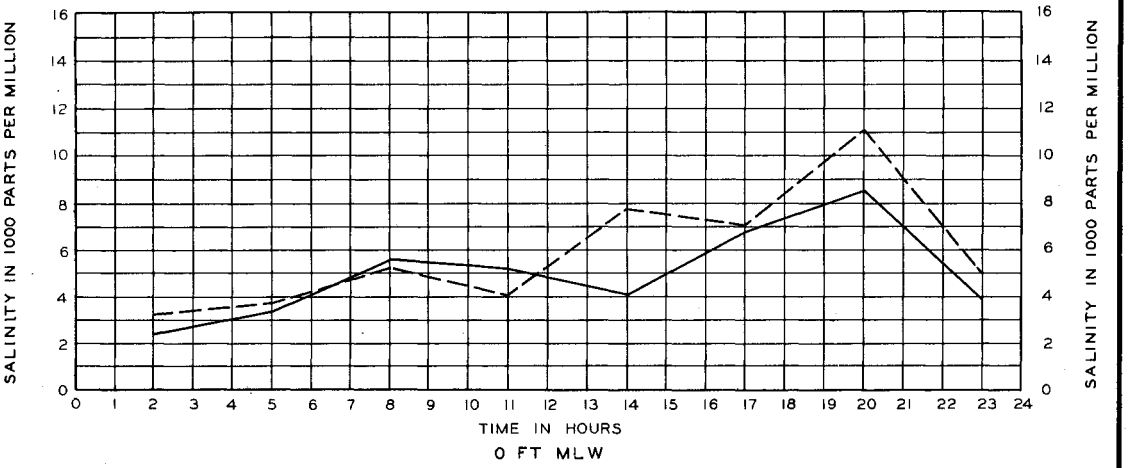
WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS

CALCASIEU RIVER DISCHARGE – 500 CFS

TEST 7 AND 16







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

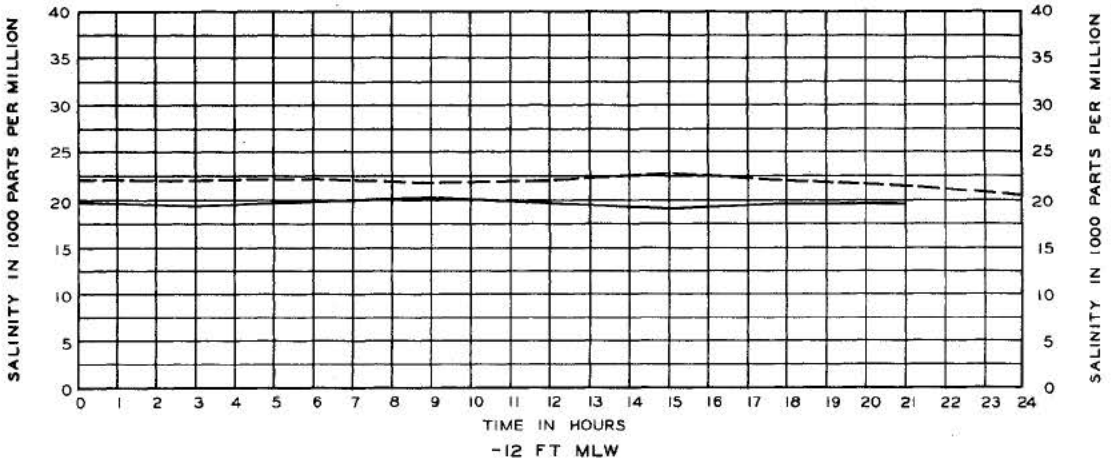
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

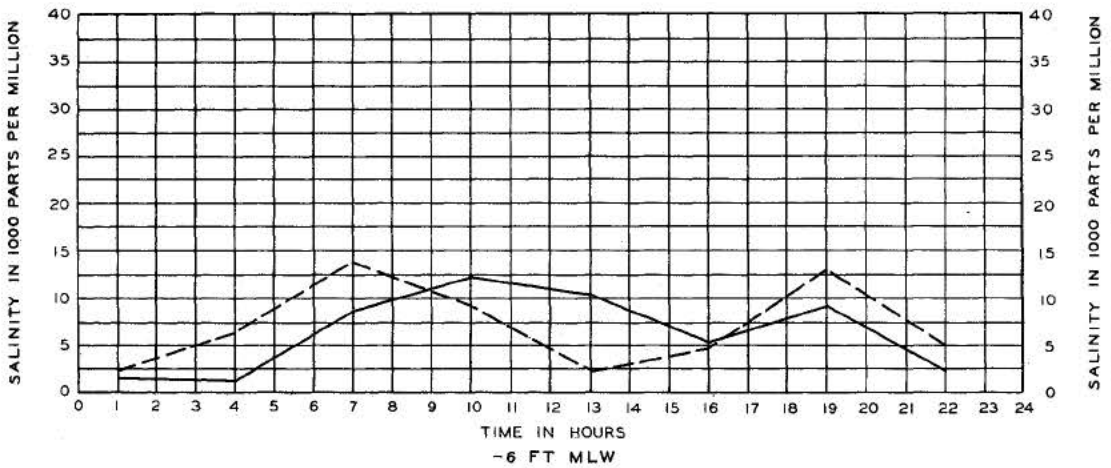
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

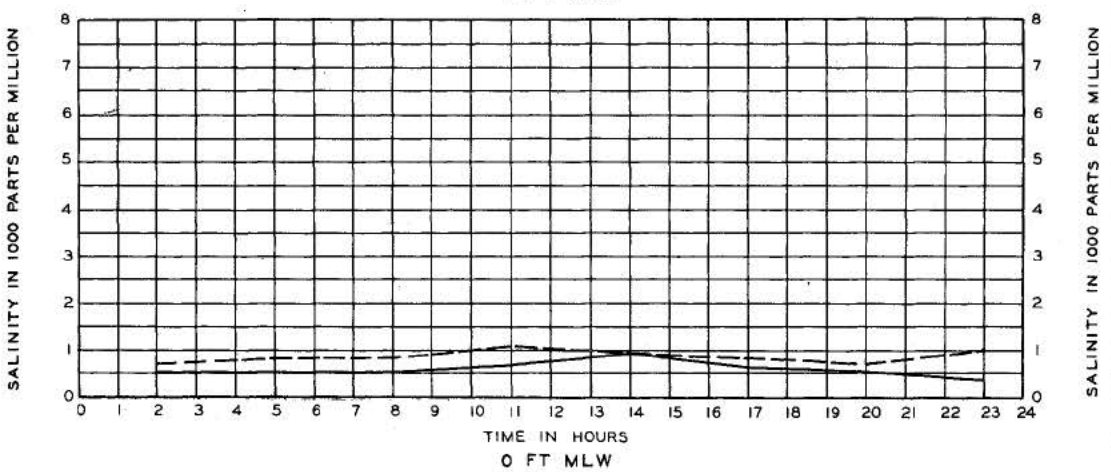
SALINITY AT STATION 6

WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 7 AND 16

PLATE 58







LEGEND

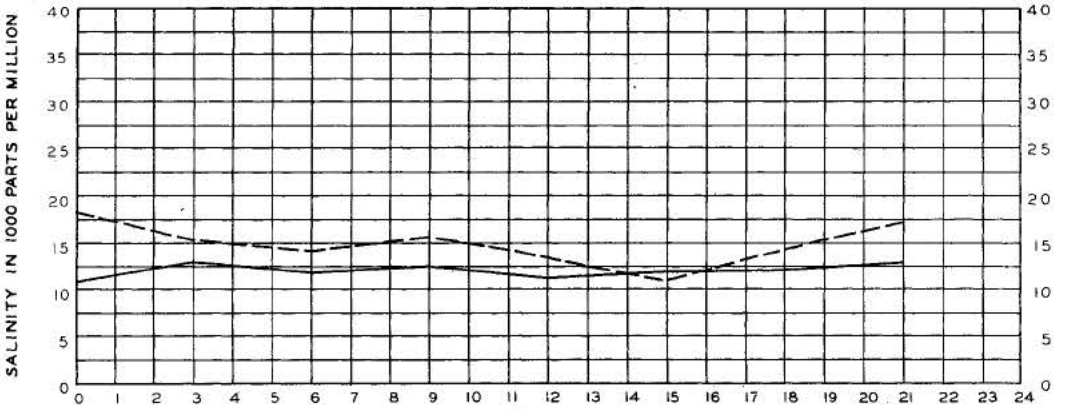
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

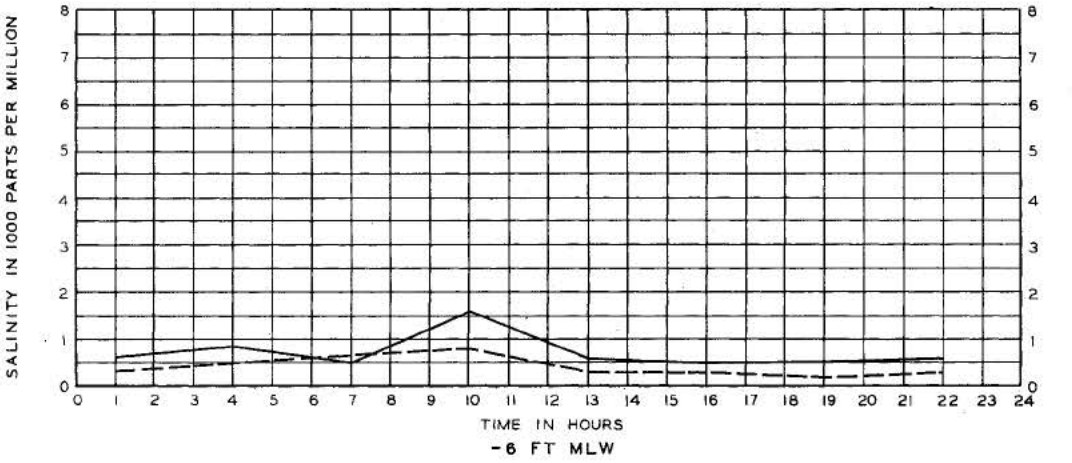
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

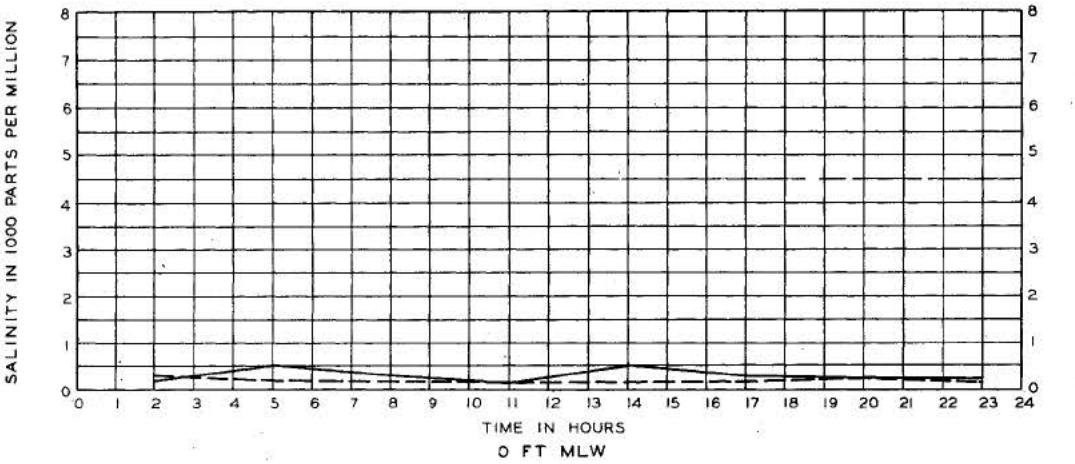
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 7

WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 7 AND 16







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

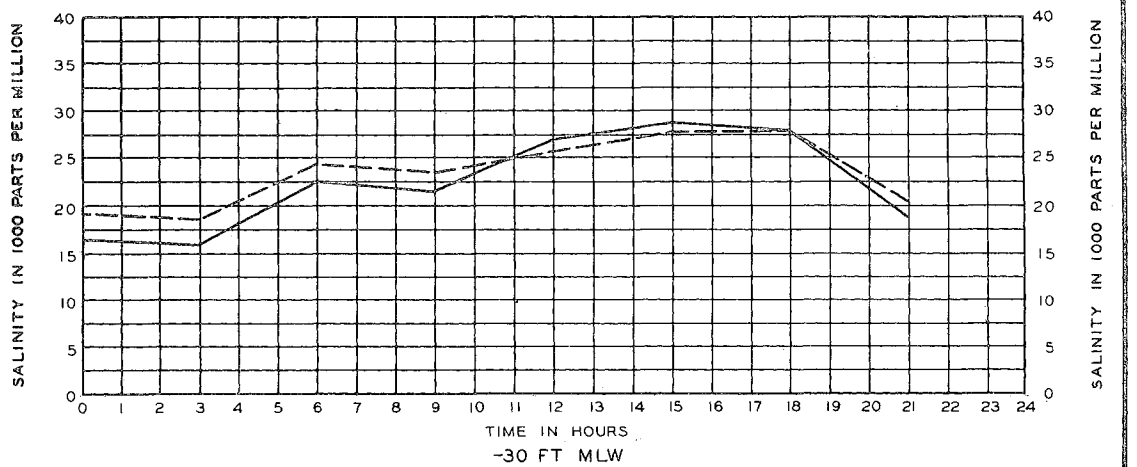
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

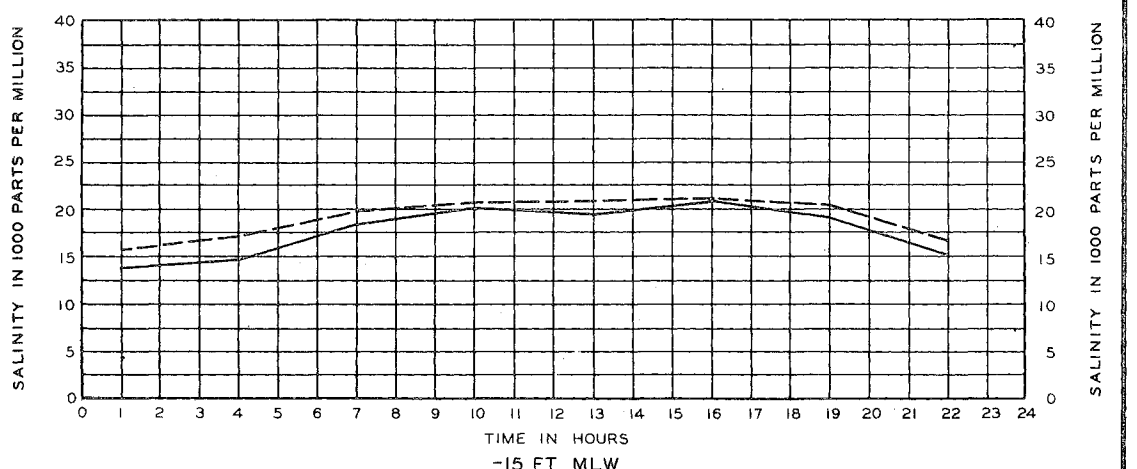
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

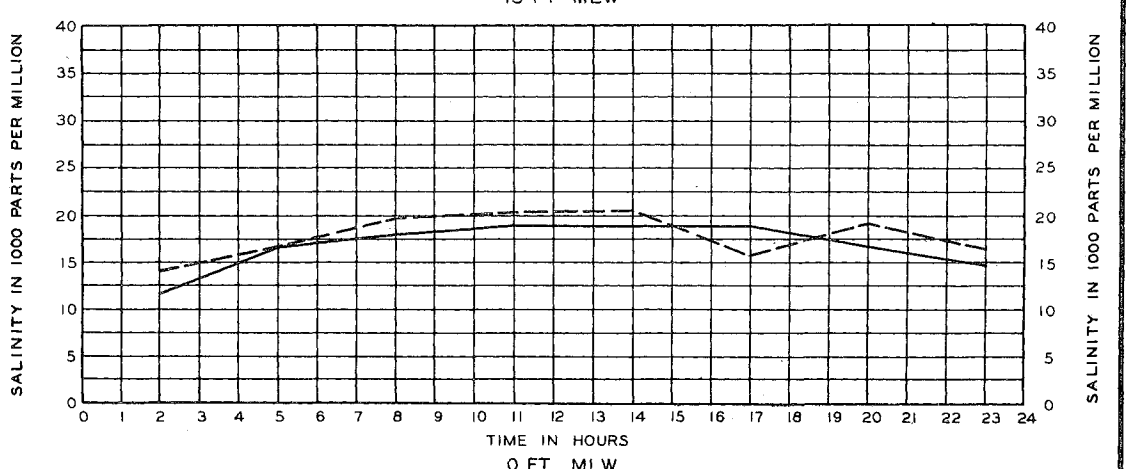
SALINITY AT STATION 8

WEST FLOW IN INTRACOASTAL WATERWAY – 300 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 7 AND 16

PLATE 60







LEGEND

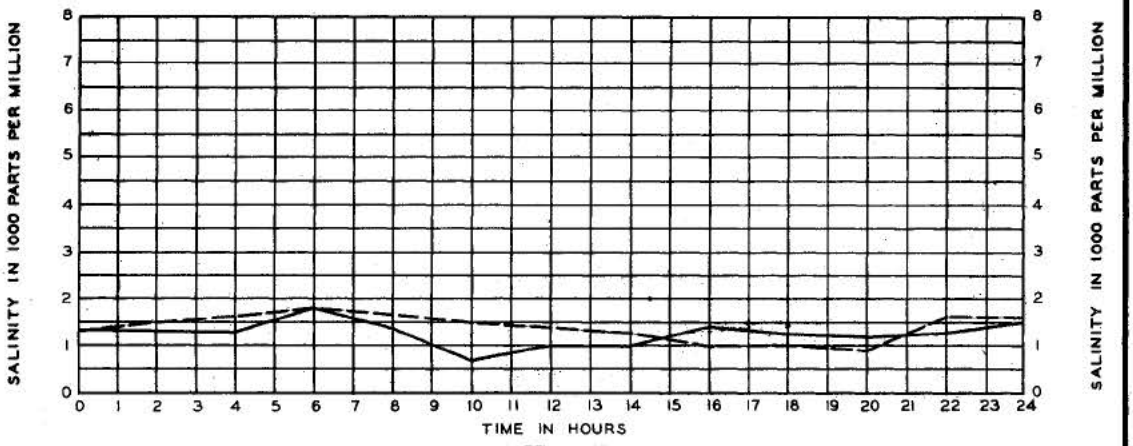
———— INDICATES TEST OF EXISTING CHANNEL DEPTH

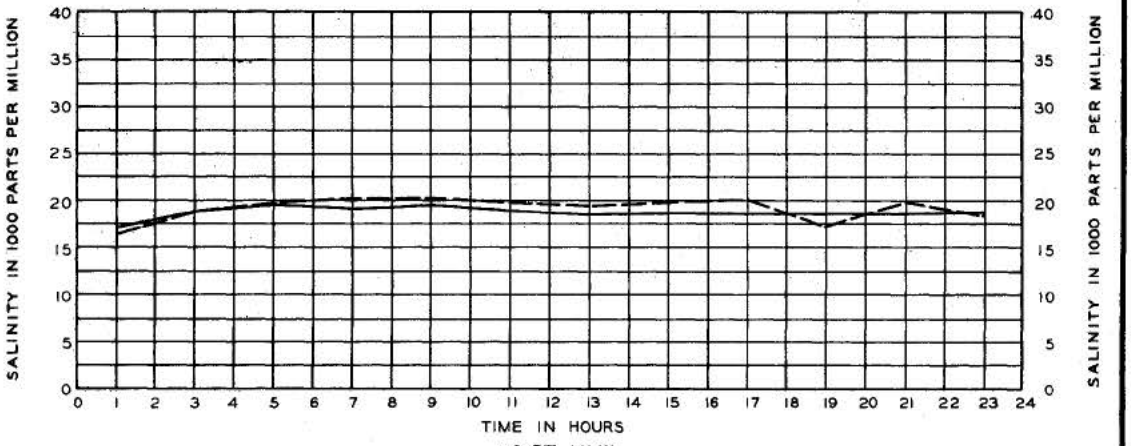
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

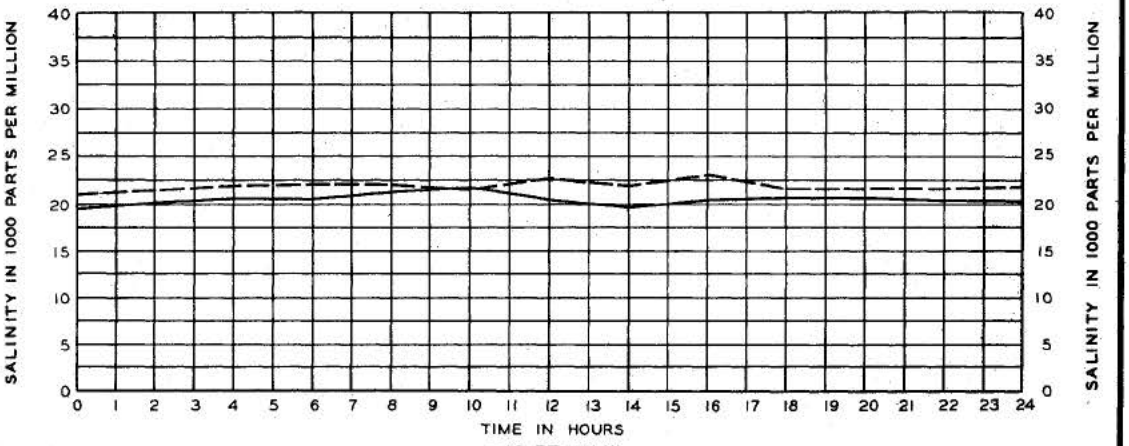
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 1

WEST FLOW IN INTRACOASTAL WATERWAY - 500 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 8 AND 17







LEGEND

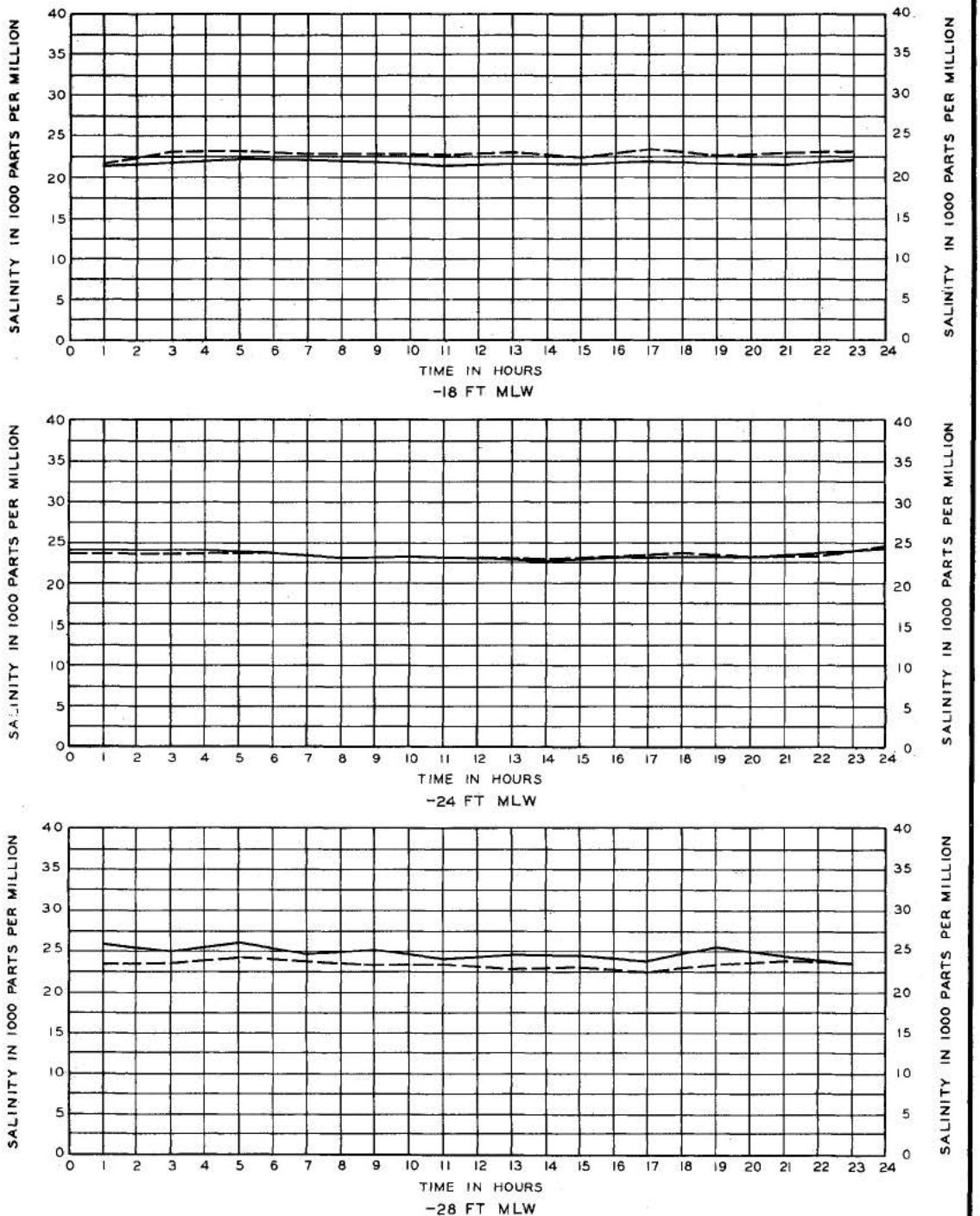
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

WEST FLOW IN INTRACOASTAL WATERWAY - 500 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 8 AND 17

PLATE 62



LEGEND

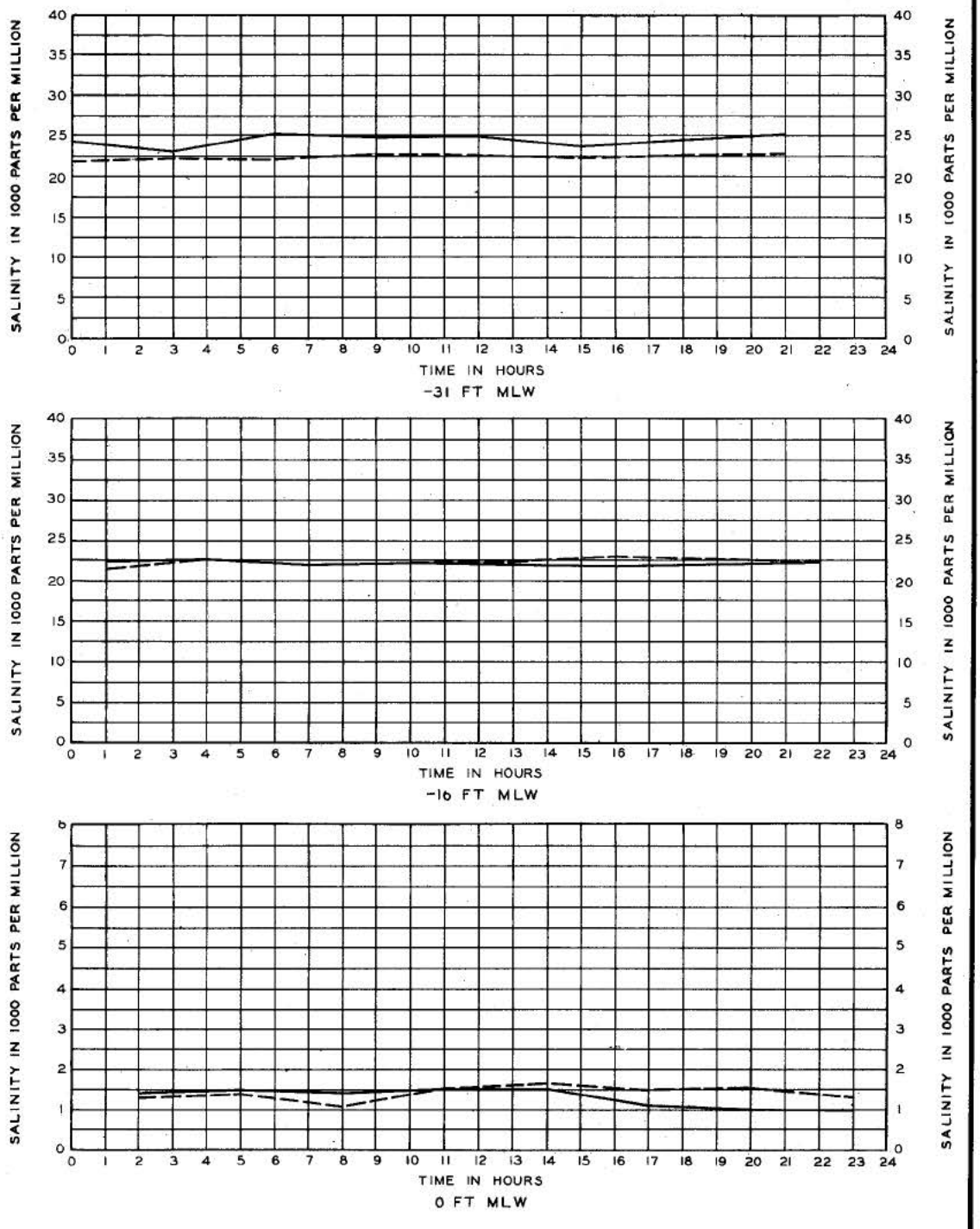
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 2

WEST FLOW IN INTRACOASTAL WATERWAY - 500 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 8 AND 17



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

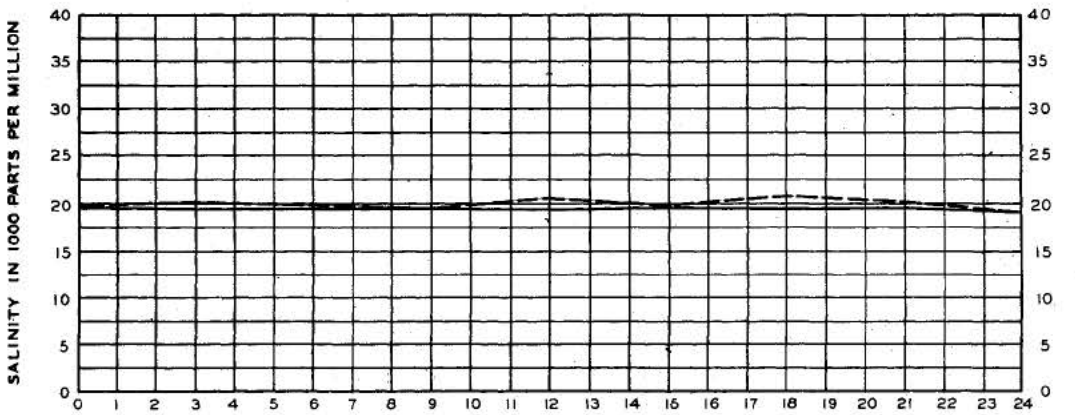
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

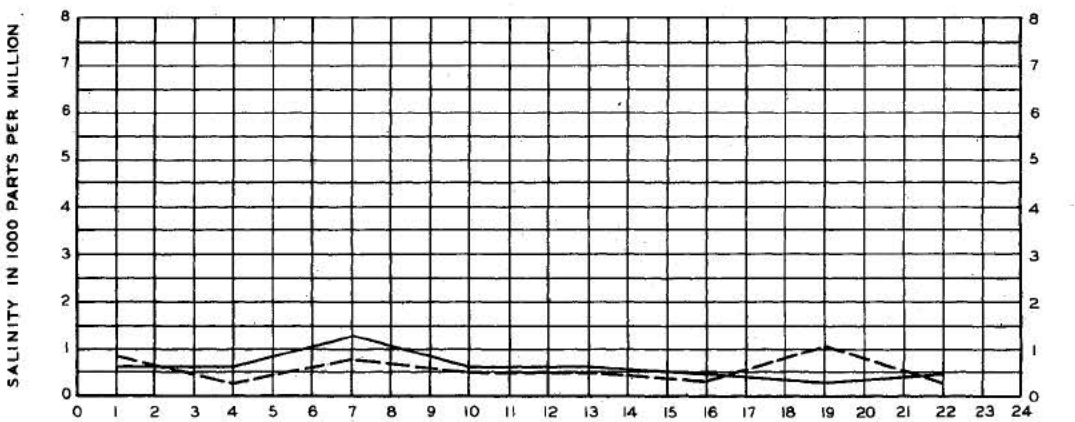
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

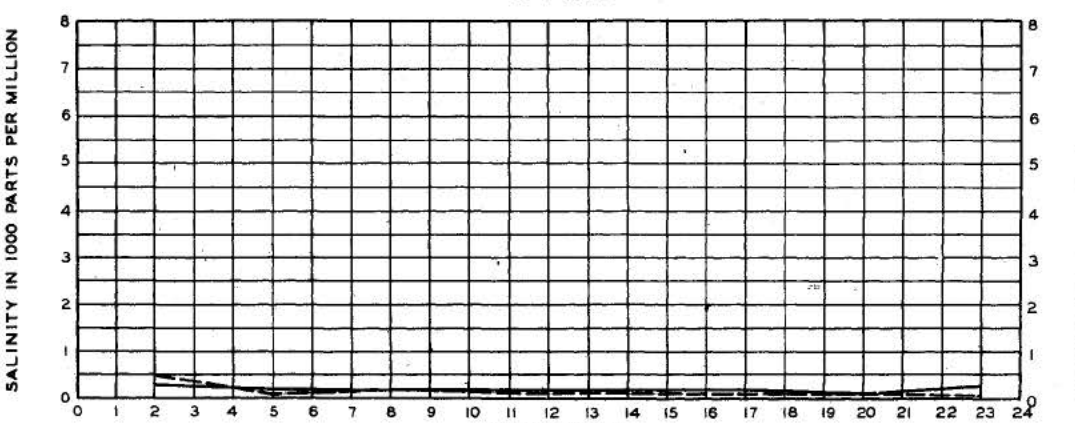
SALINITY AT STATION 3

WEST FLOW IN INTRACOASTAL WATERWAY - 500 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 8 AND 17

PLATE 64







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

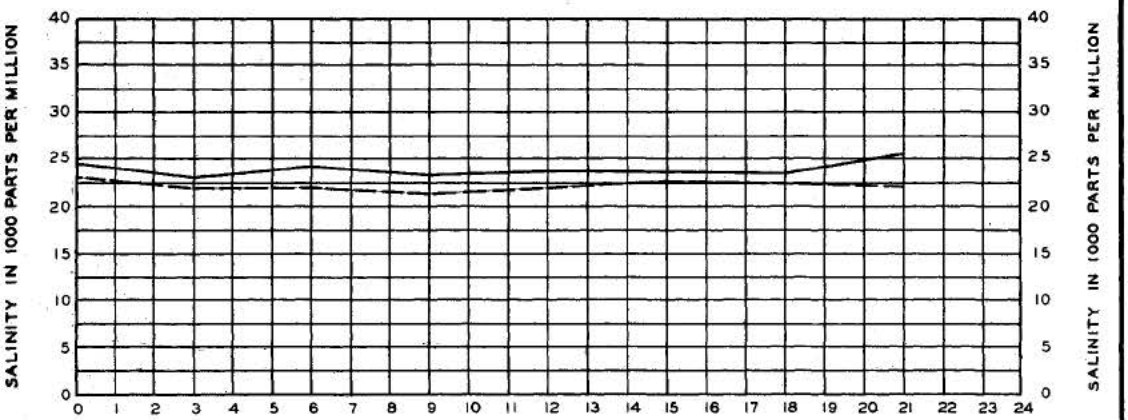
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

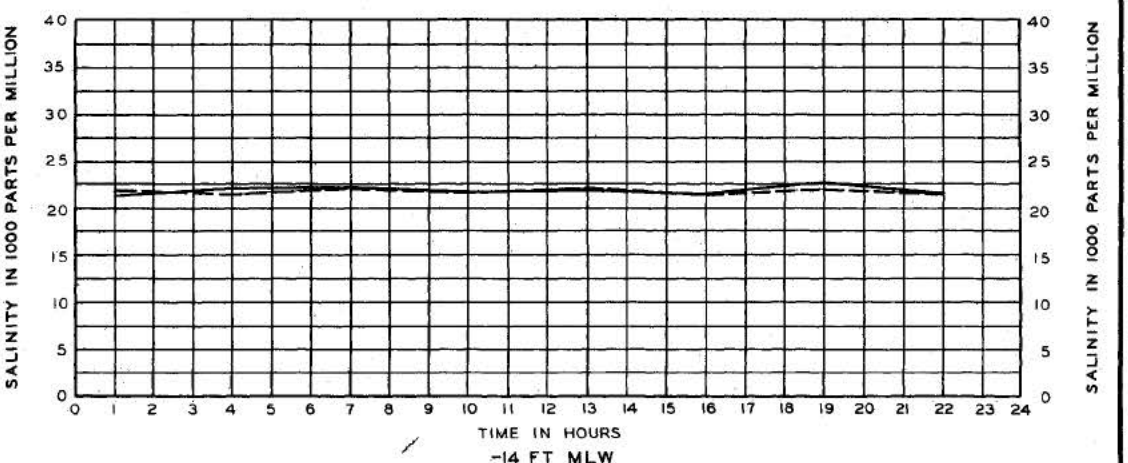
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

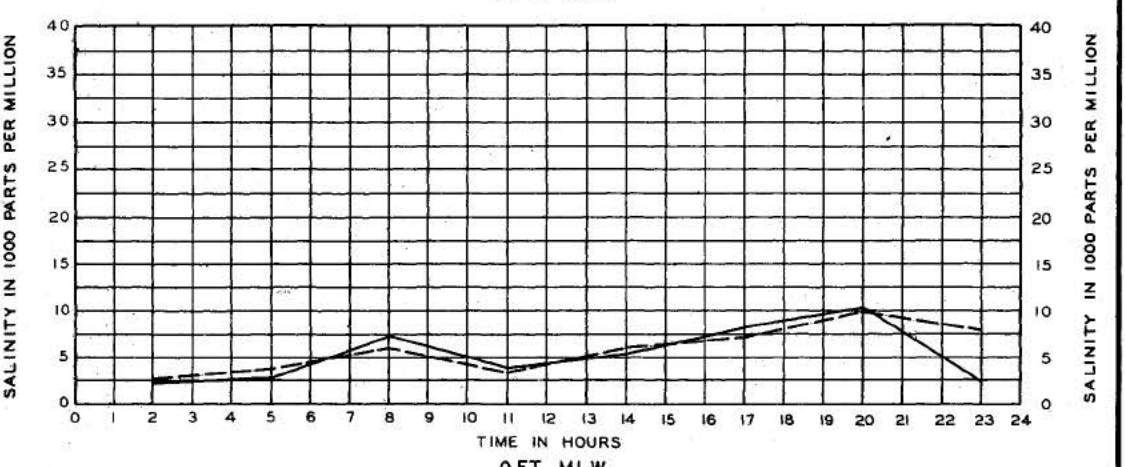
SALINITY AT STATION 5

WEST FLOW IN INTRACOASTAL WATERWAY – 500 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 8 AND 17

PLATE 65







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

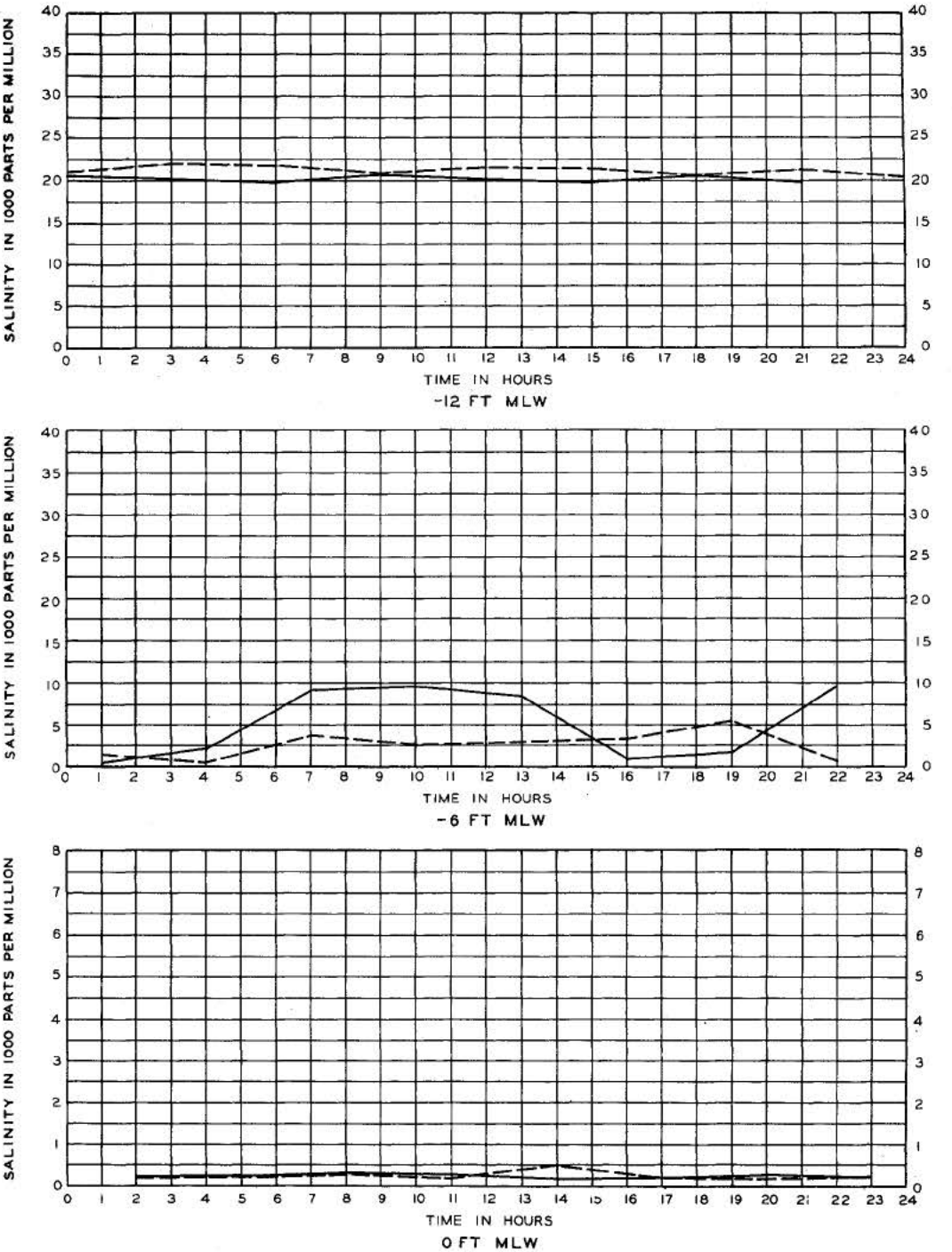
SALINITY AT STATION 6

WEST FLOW IN INTRACOASTAL WATERWAY – 500 CFS

CALCASIEU RIVER DISCHARGE – 500 CFS

TEST 8 AND 17

PLATE 66



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

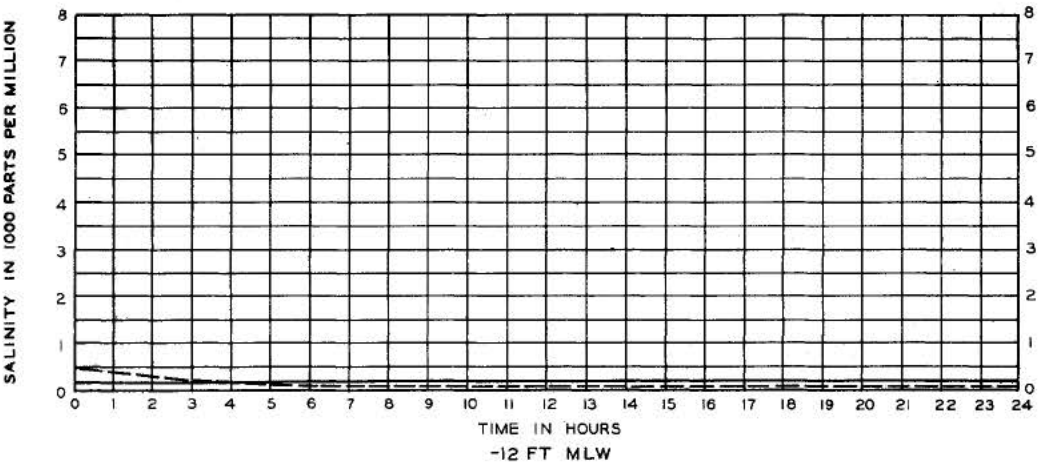
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

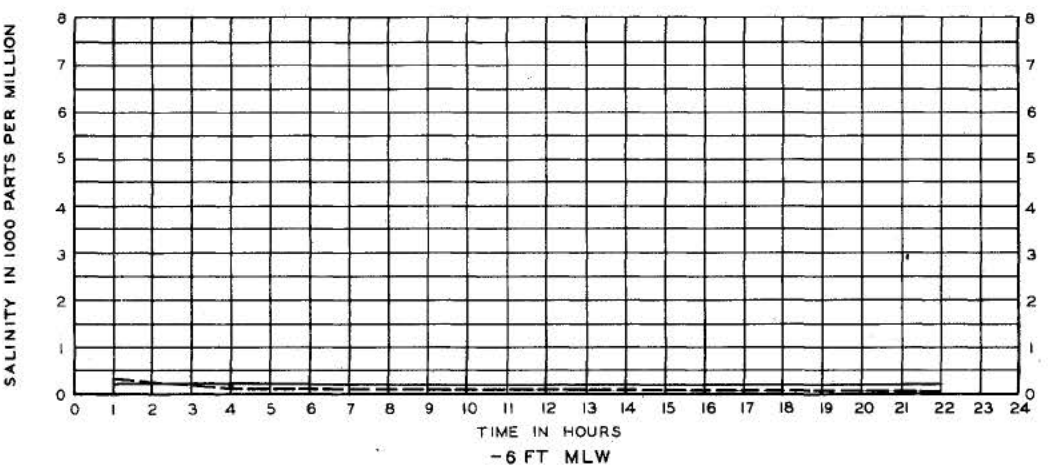
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

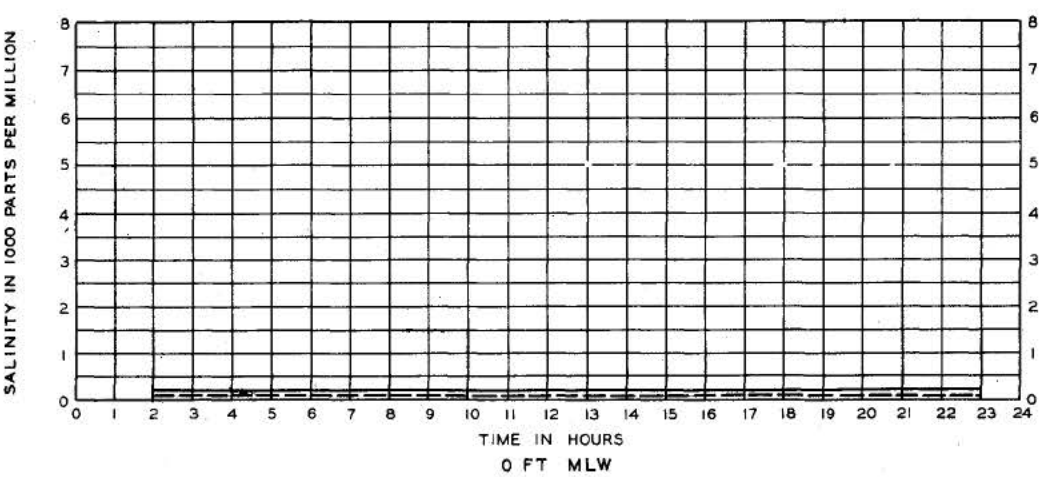
SALINITY AT STATION 7

WEST FLOW IN INTRACOASTAL WATERWAY – 500 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 8 AND 17

PLATE 67







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

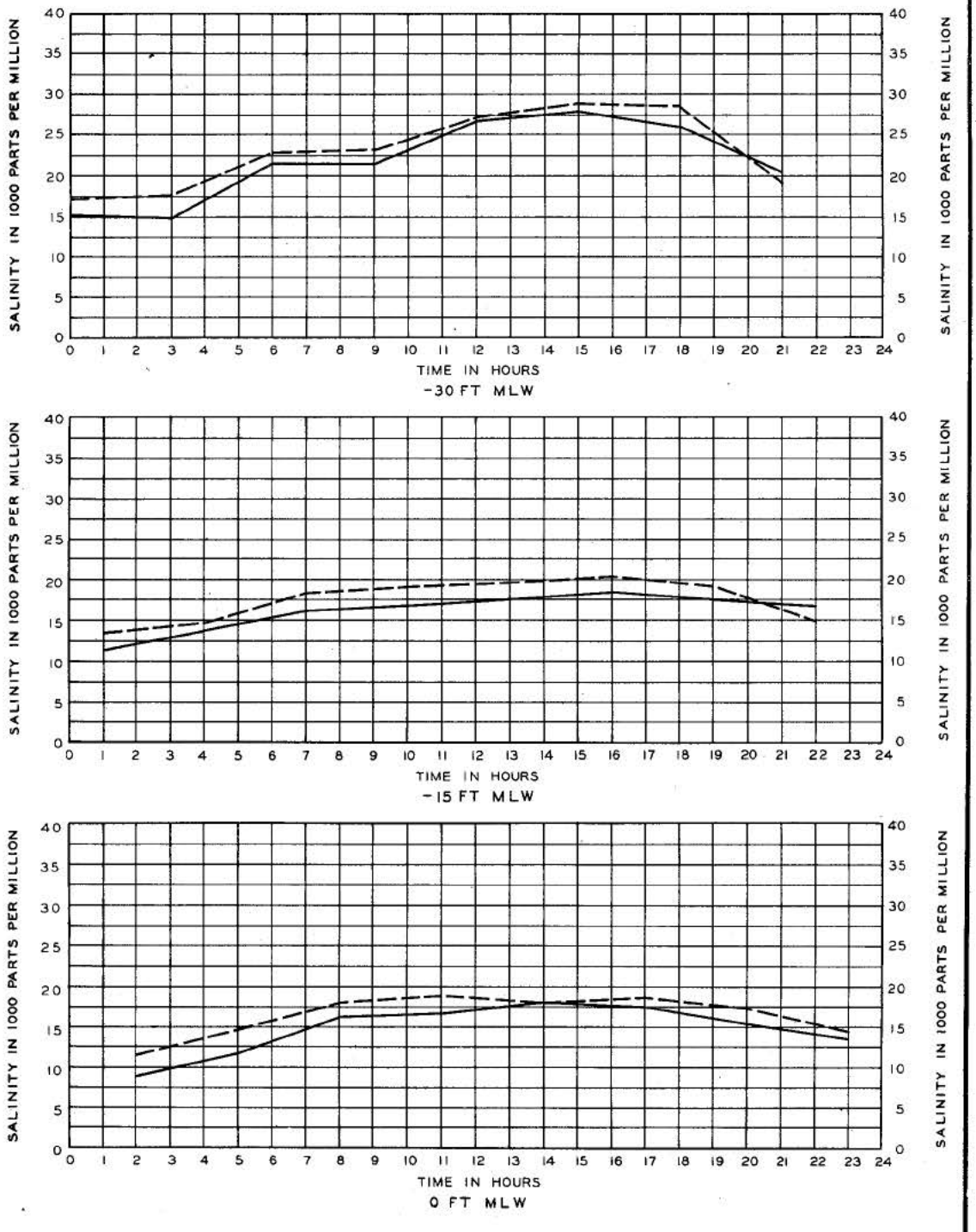
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 8

WEST FLOW IN INTRACOASTAL WATERWAY – 500 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 8 AND 17

PLATE 68



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

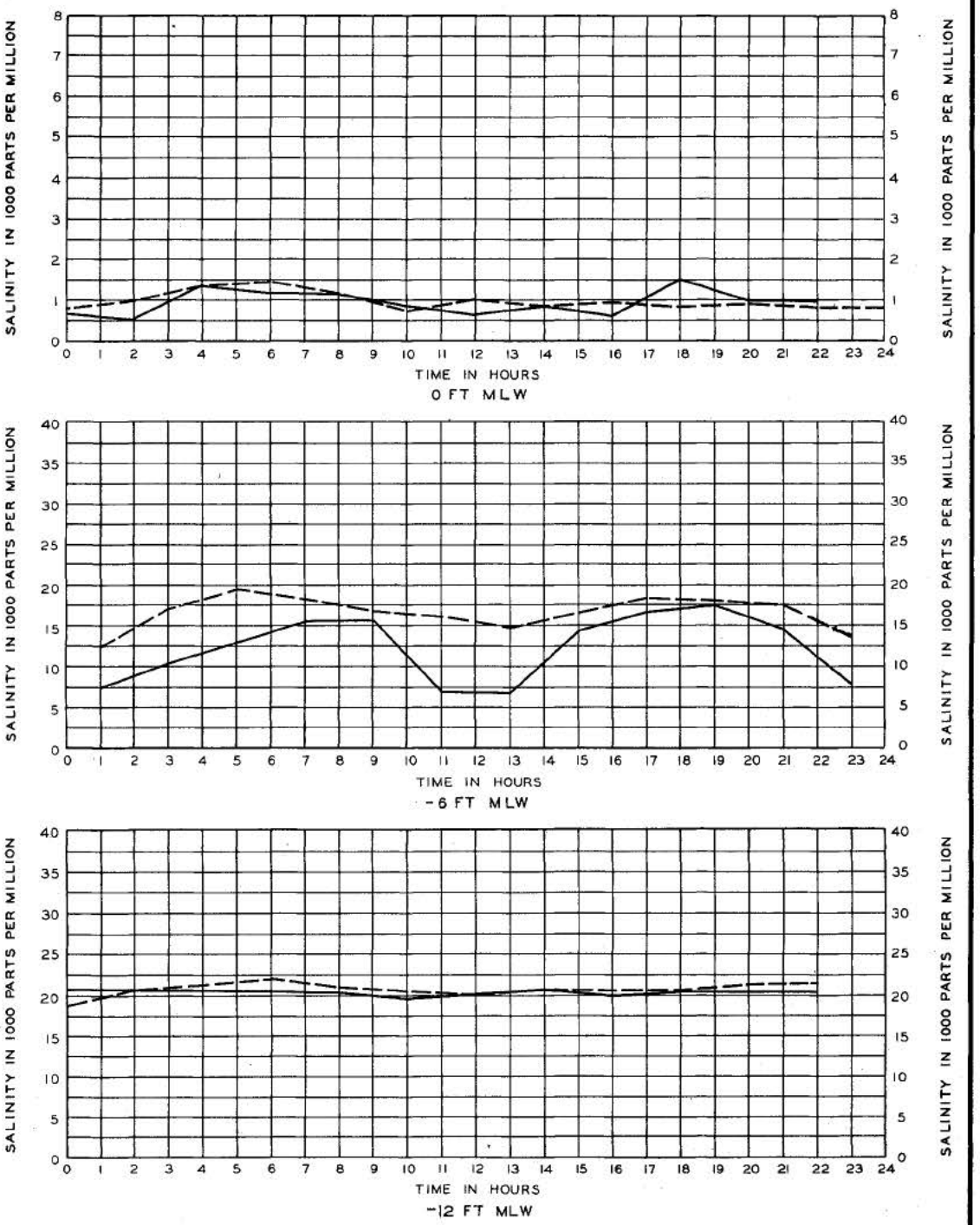
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 1

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18

PLATE 69

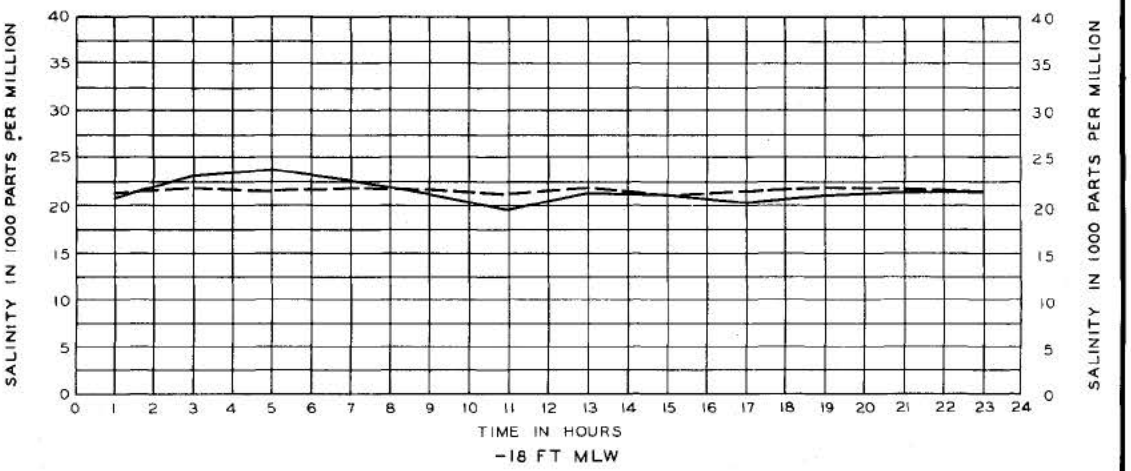


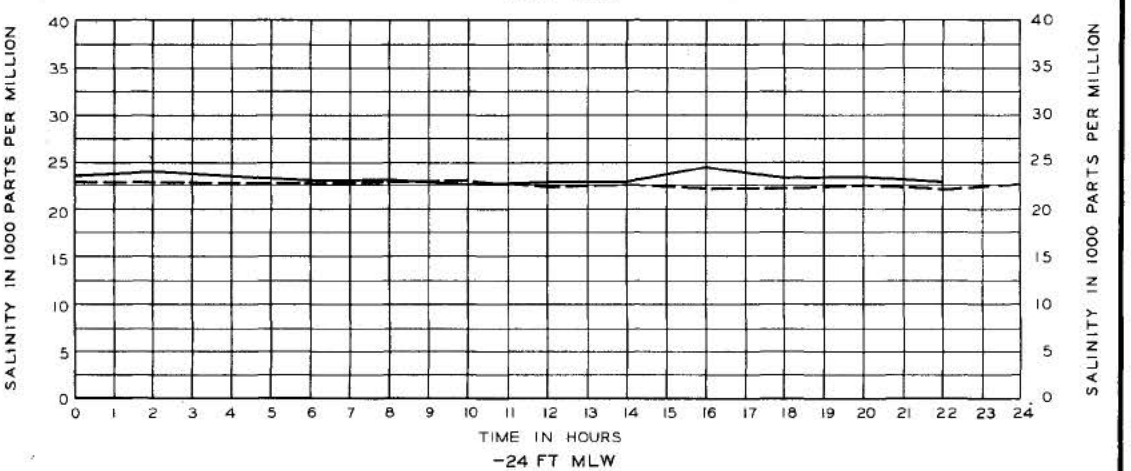
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN. SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

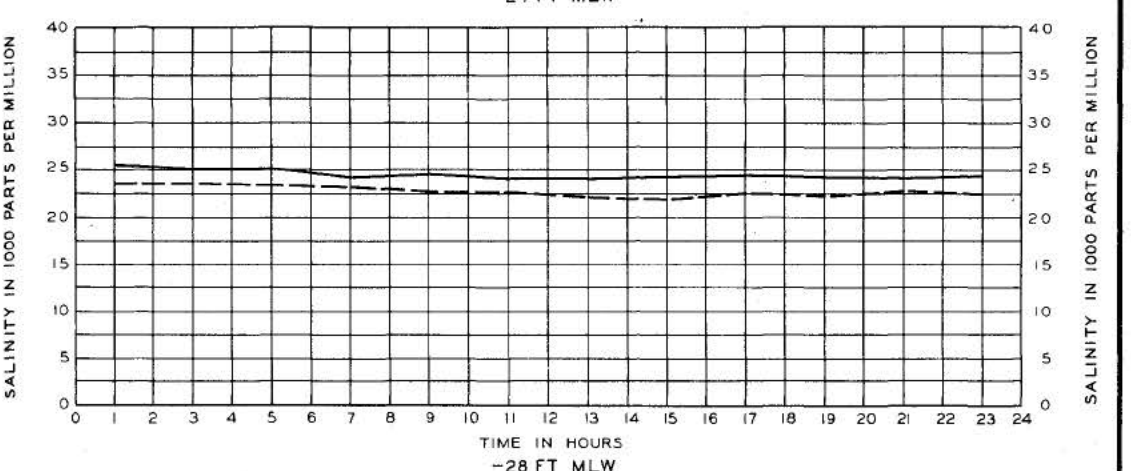
SALINITY AT STATION 2

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18

PLATE 70







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

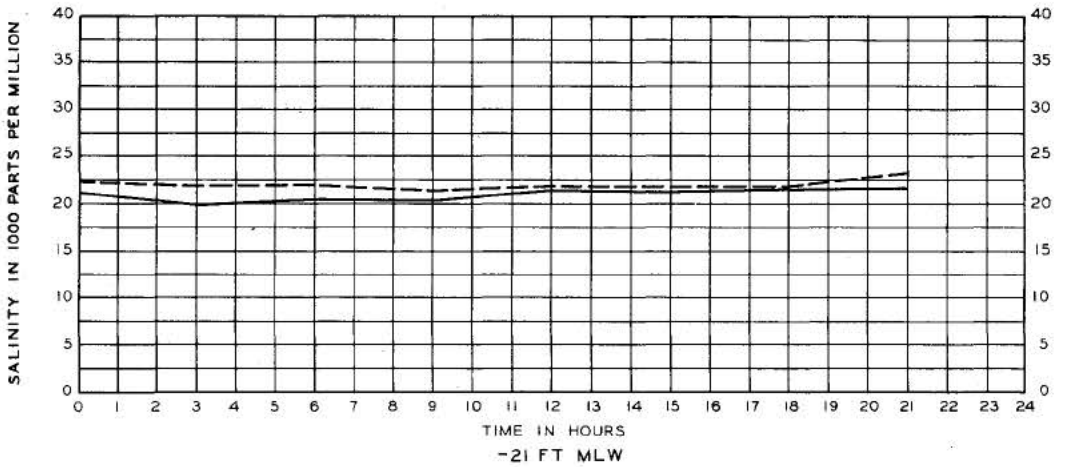
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

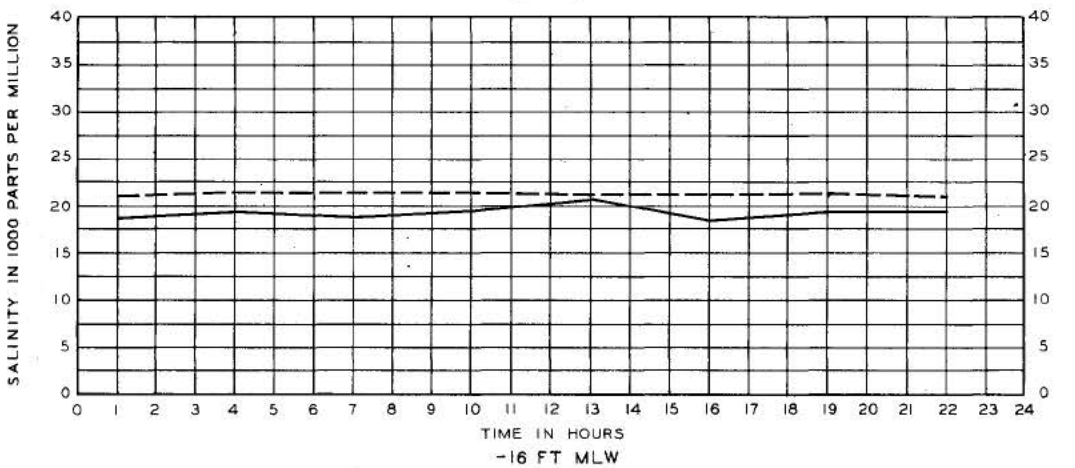
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

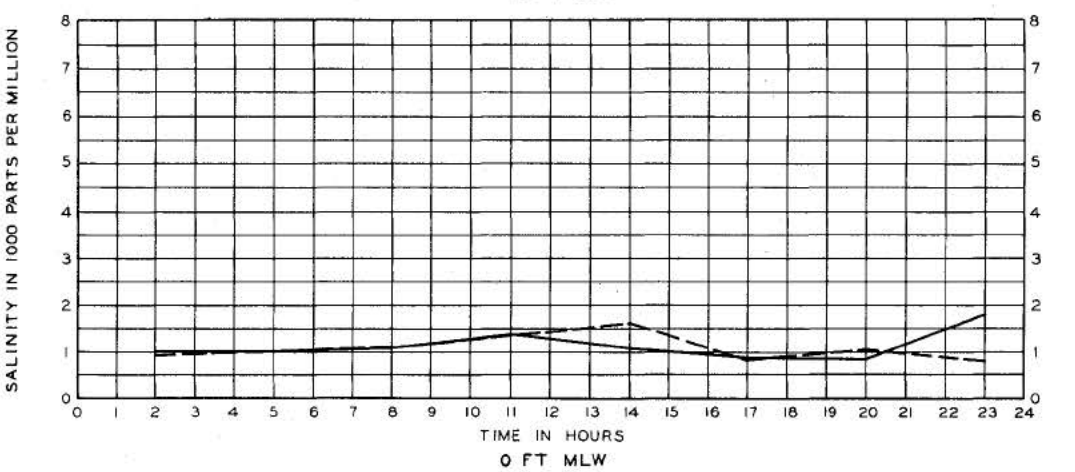
SALINITY AT STATION 2

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18

PLATE 71







LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

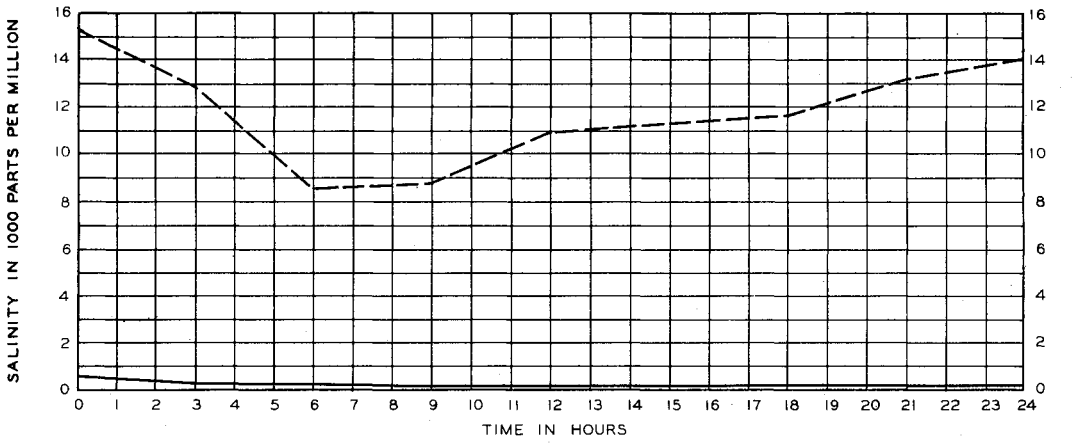
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

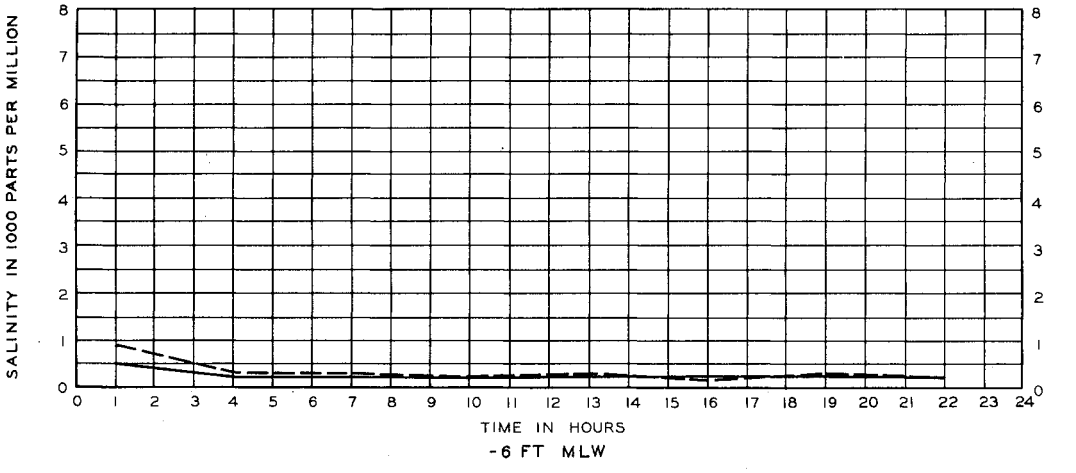
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

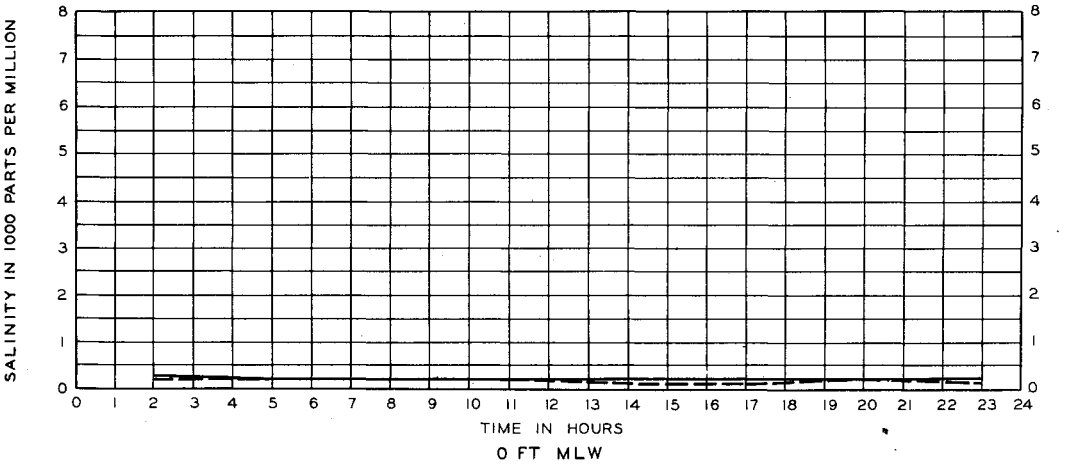
SALINITY AT STATION 3

WEST FLOW IN INTRACOASTAL WATERWAY – 800 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 9 AND 18

PLATE 72







LEGEND

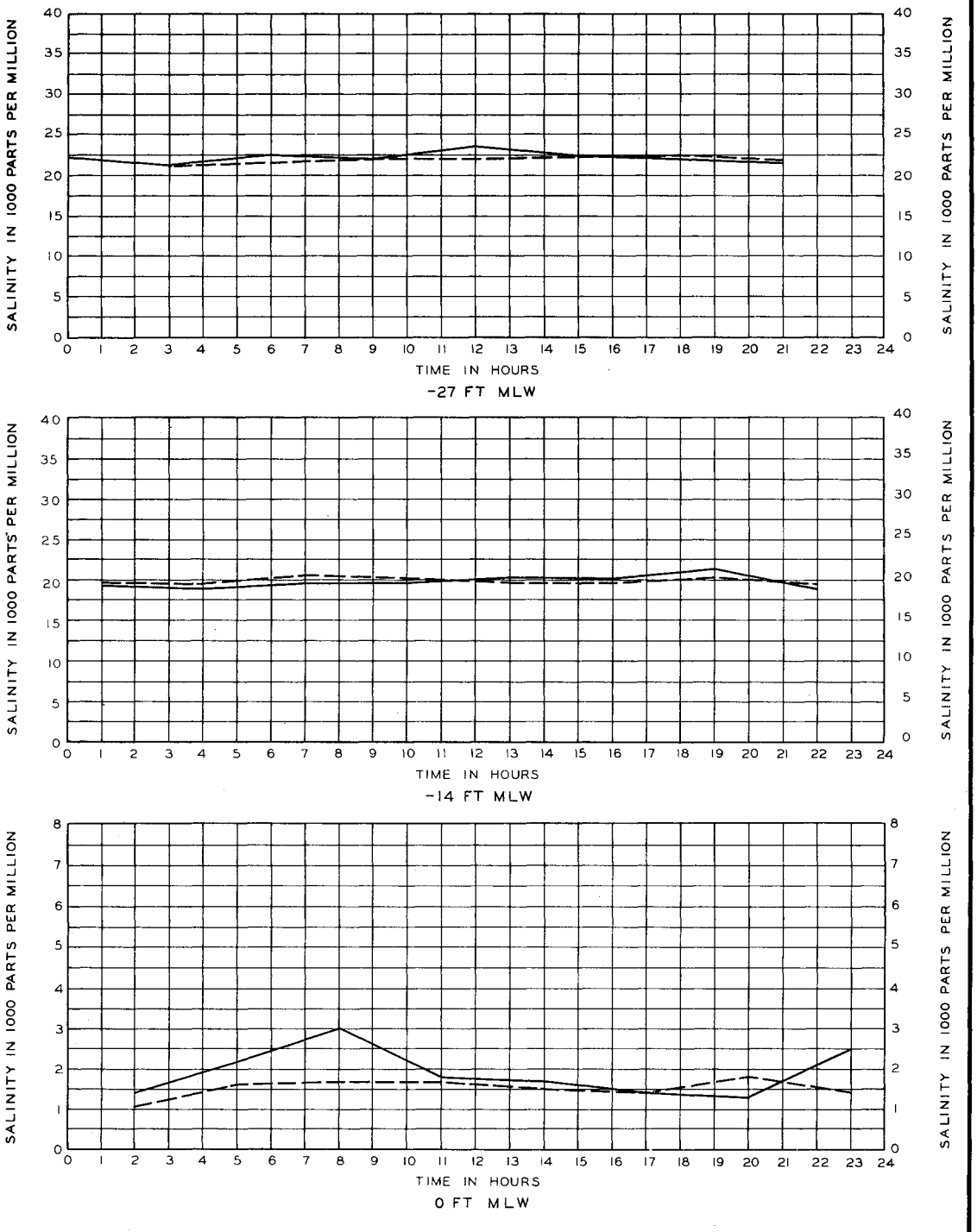
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 5

WEST FLOW IN INTRACOASTAL WATERWAY – 800 CFS
CALCASIEU RIVER DISCHARGE – 500 CFS
TEST 9 AND 18

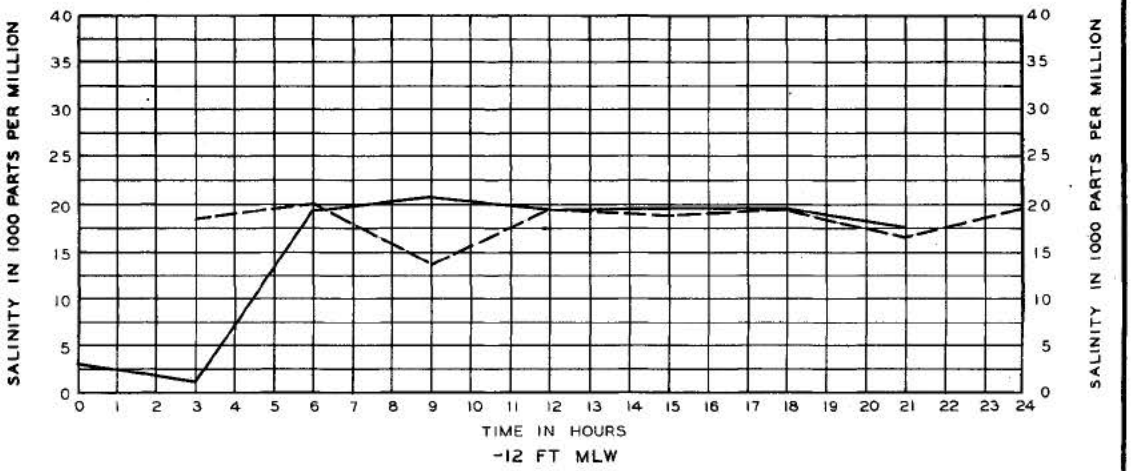


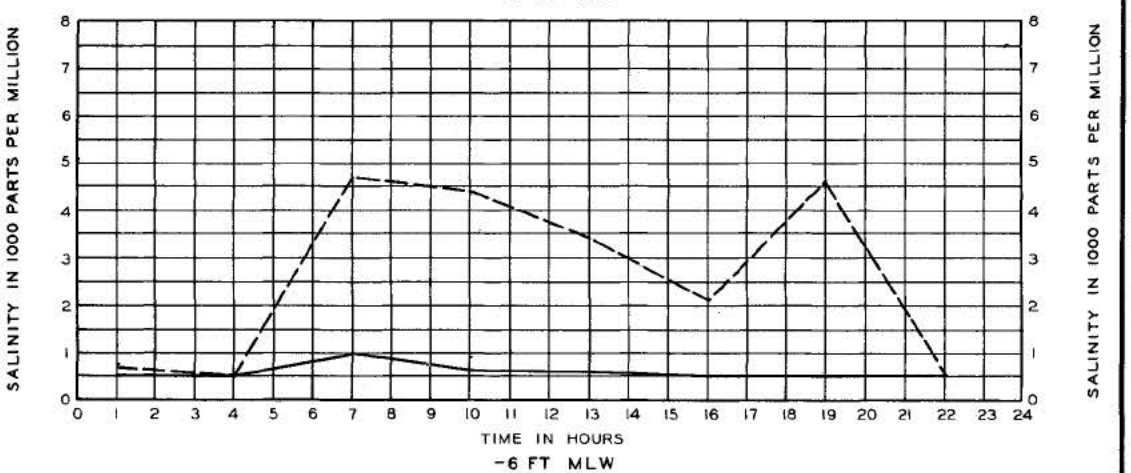
NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

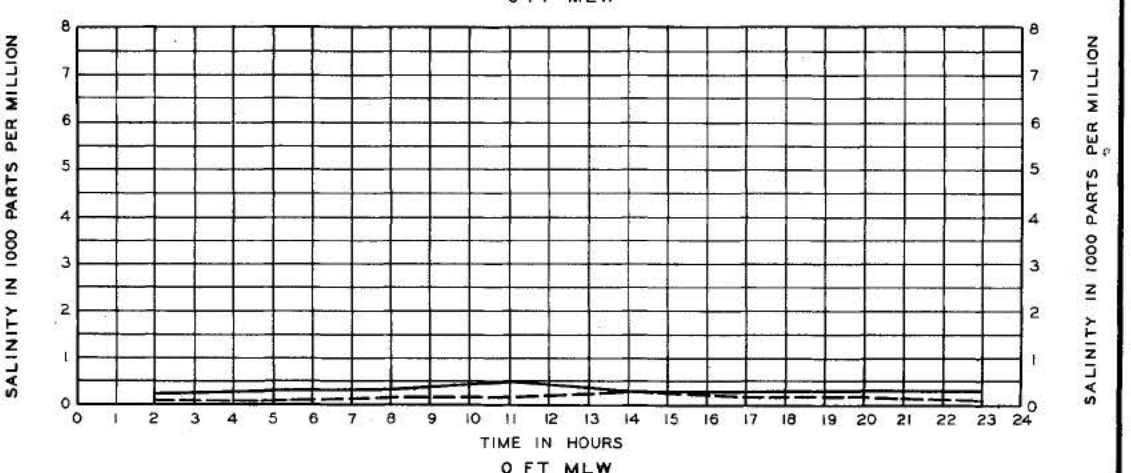
SALINITY AT STATION 6

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18

PLATE 74







LEGEND

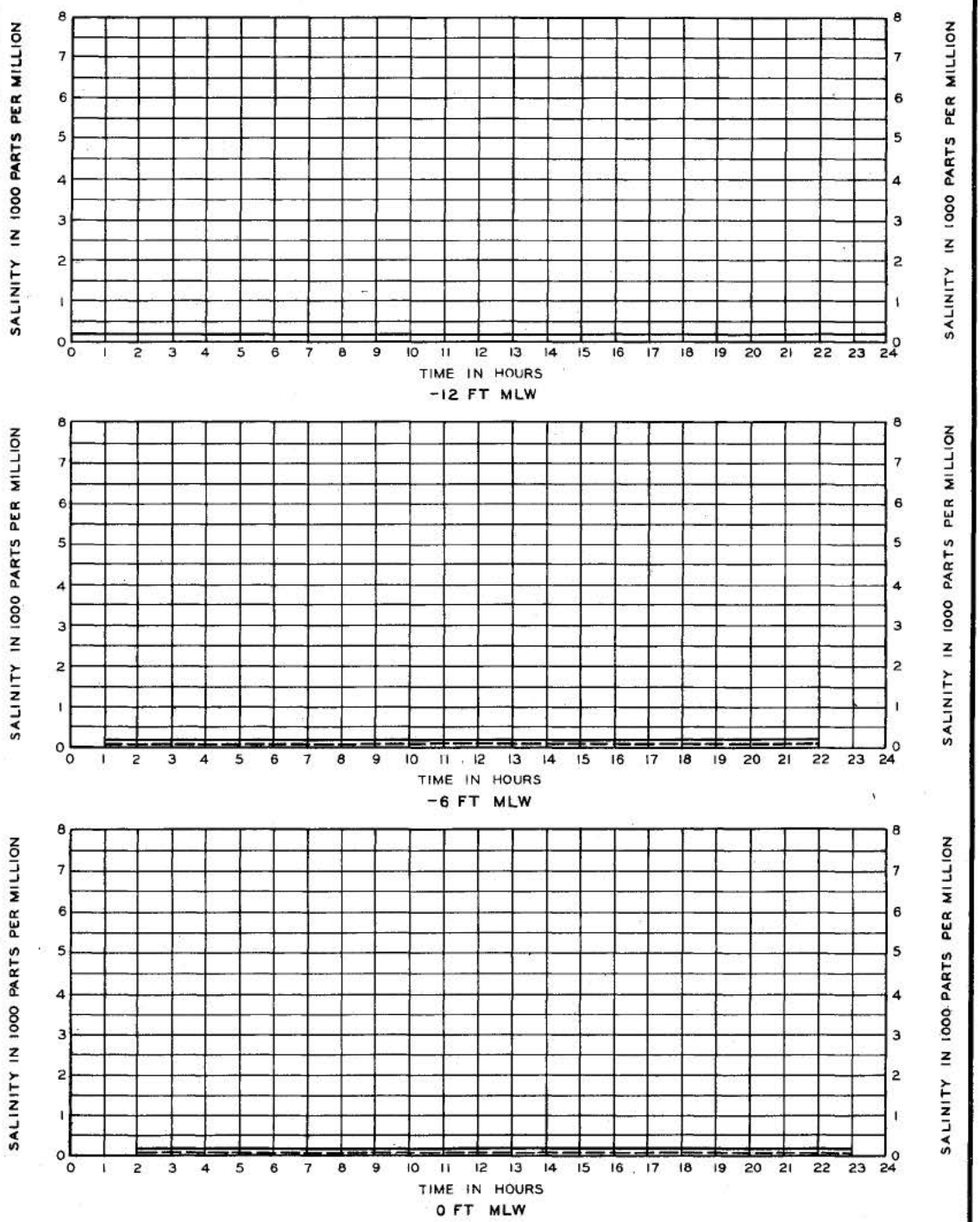
——— INDICATES TEST OF EXISTING CHANNEL DEPTH

– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

SALINITY AT STATION 7

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18



LEGEND

——— INDICATES TEST OF EXISTING CHANNEL DEPTH

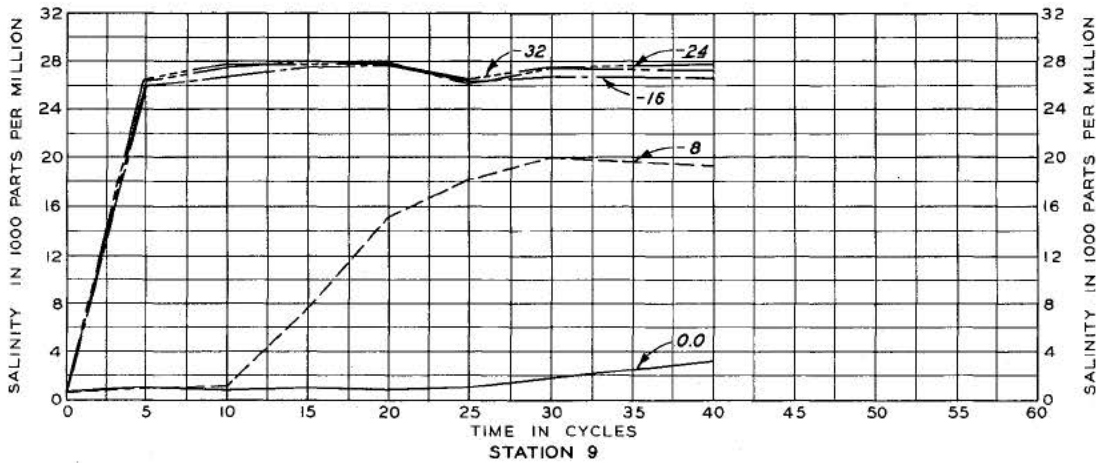
– – – – – – INDICATES TEST OF PROPOSED CHANNEL DEPTH

NOTE: TIME IS EXPRESSED IN HOURS AFTER MOONS TRANSIT OF CAMERON MERIDIAN.
SALINITY VALUES PLOTTED REPRESENT ACTUAL SALINITIES MEASURED DURING ONE TIDAL CYCLE AT INDICATED DEPTH.

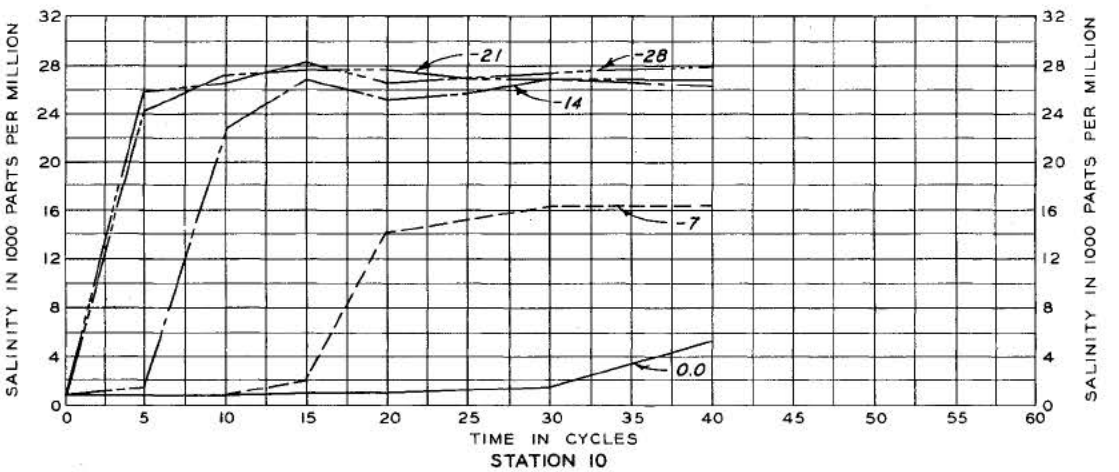
SALINITY AT STATION 8

WEST FLOW IN INTRACOASTAL WATERWAY - 800 CFS
CALCASIEU RIVER DISCHARGE - 500 CFS
TEST 9 AND 18

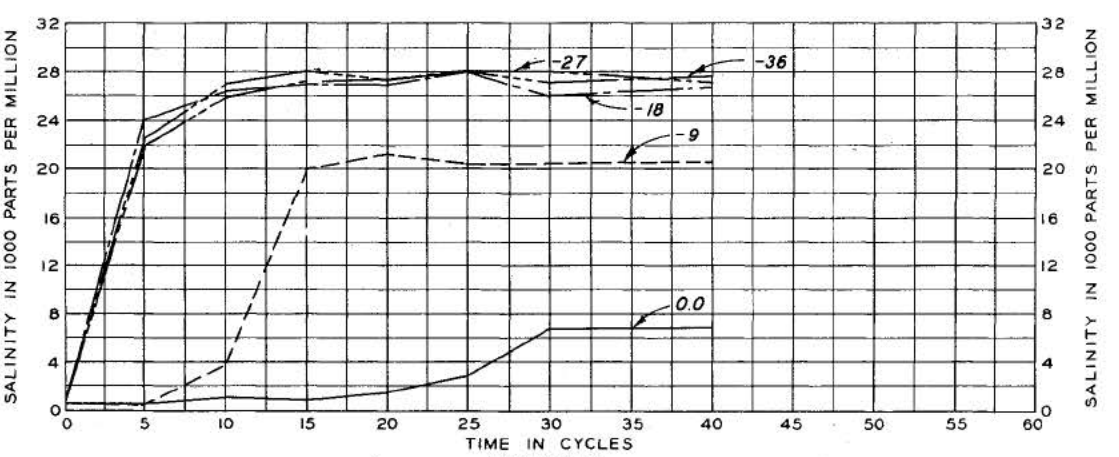
PLATE 76



STATION 9



STATION 10



STATION 11

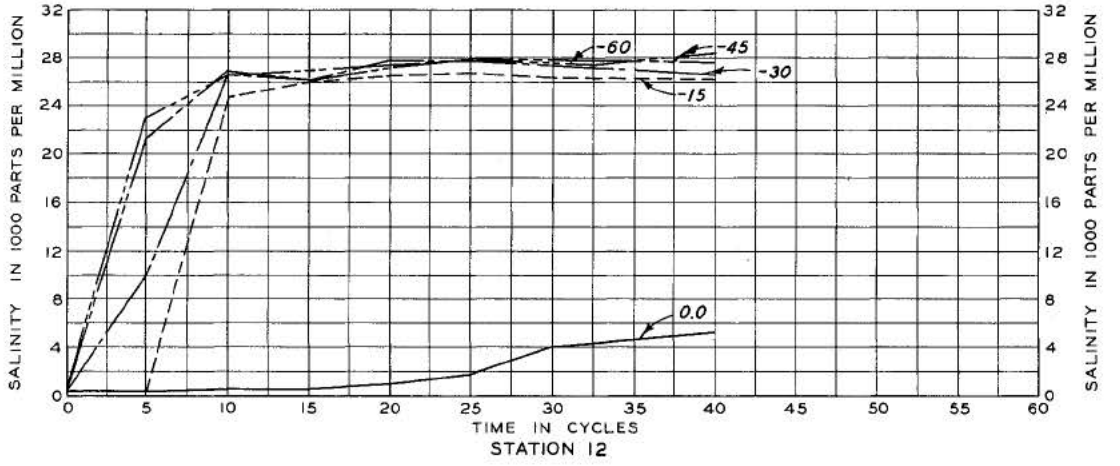
LEGEND

- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

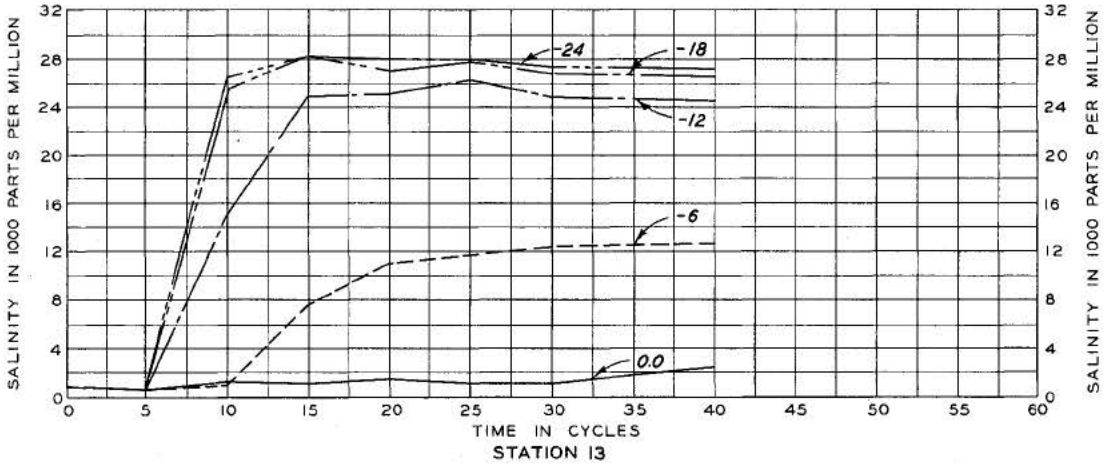
NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

SALINITY OBSERVATIONS

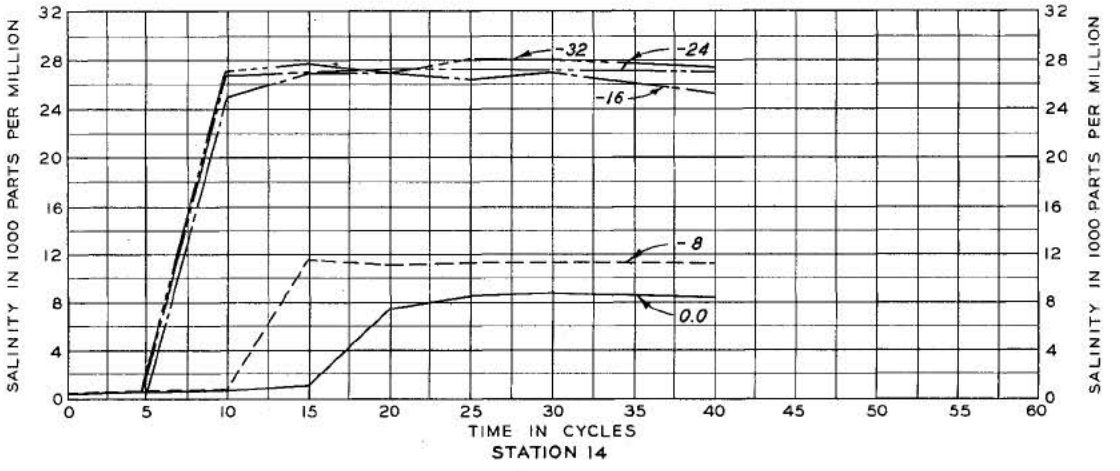
CALCASIEU RIVER DISCHARGE 500 CFS
34-FT CHANNEL CONDITIONS
TEST 21



STATION 12



STATION 13



STATION 14

LEGEND

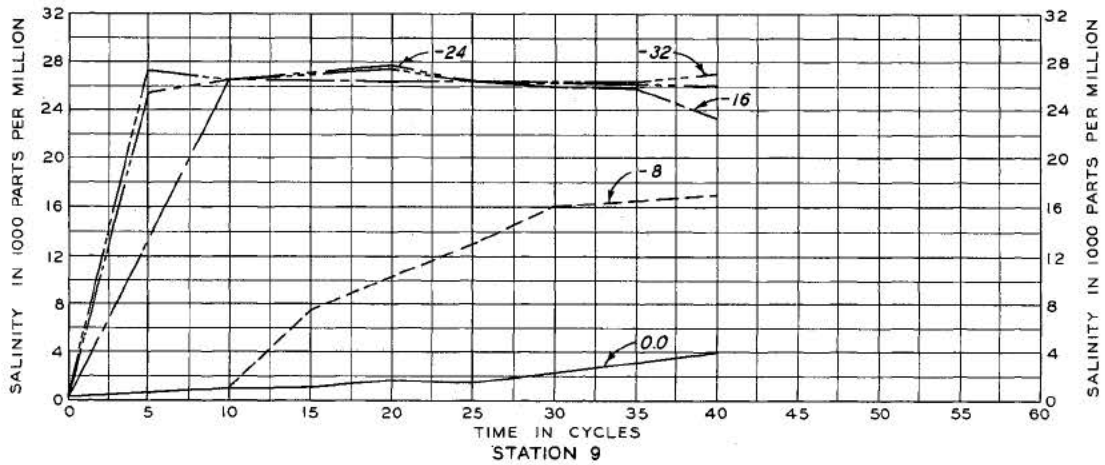
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

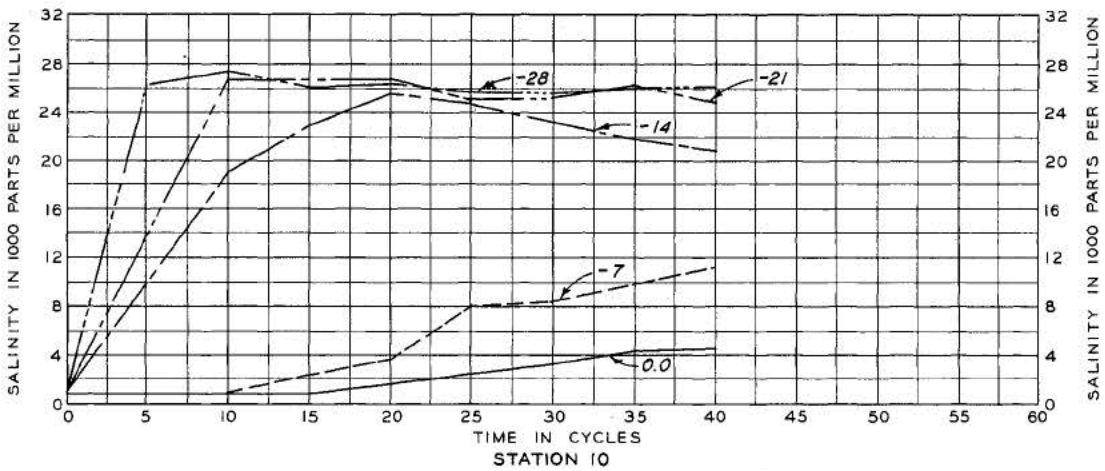
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE 500 CFS
34-FT CHANNEL CONDITIONS
TEST 21

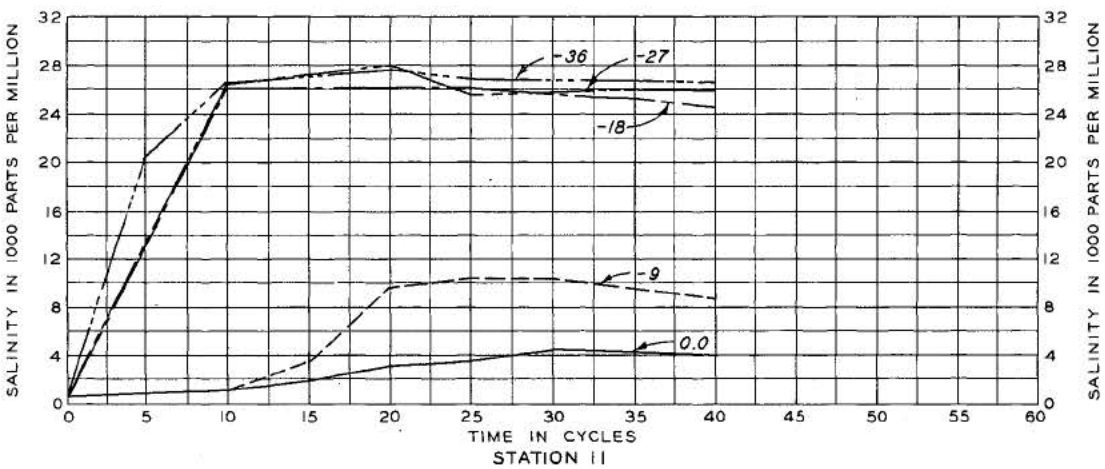
PLATE 78



STATION 9



STATION 10



STATION 11

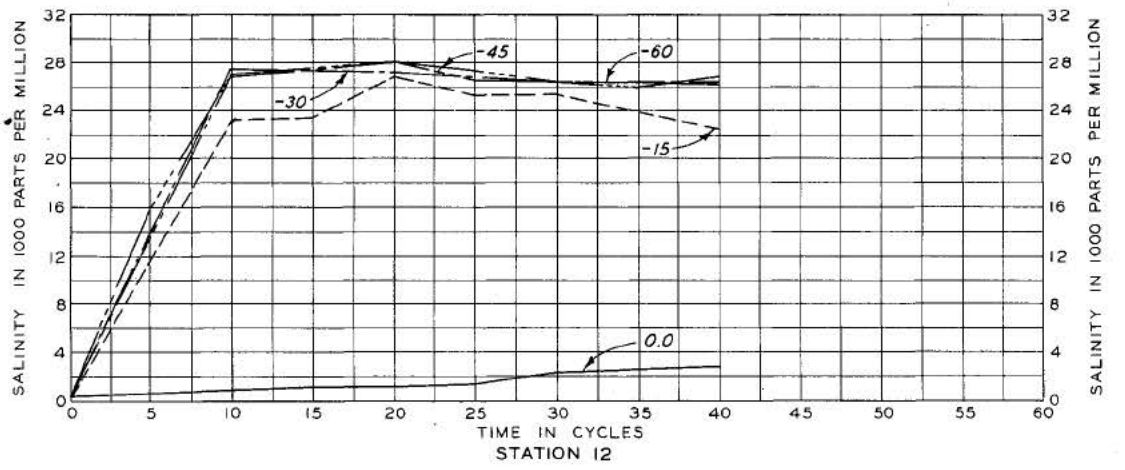
LEGEND

- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

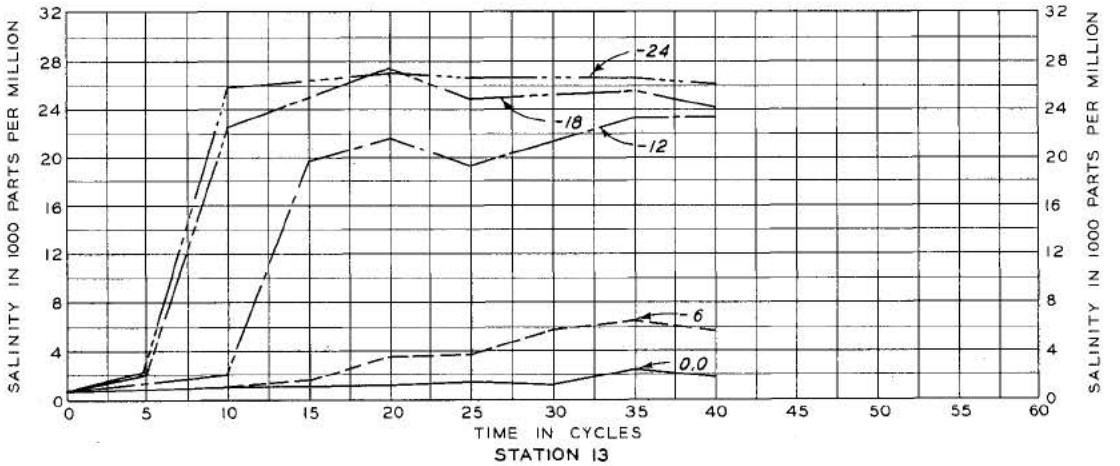
NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

SALINITY OBSERVATIONS

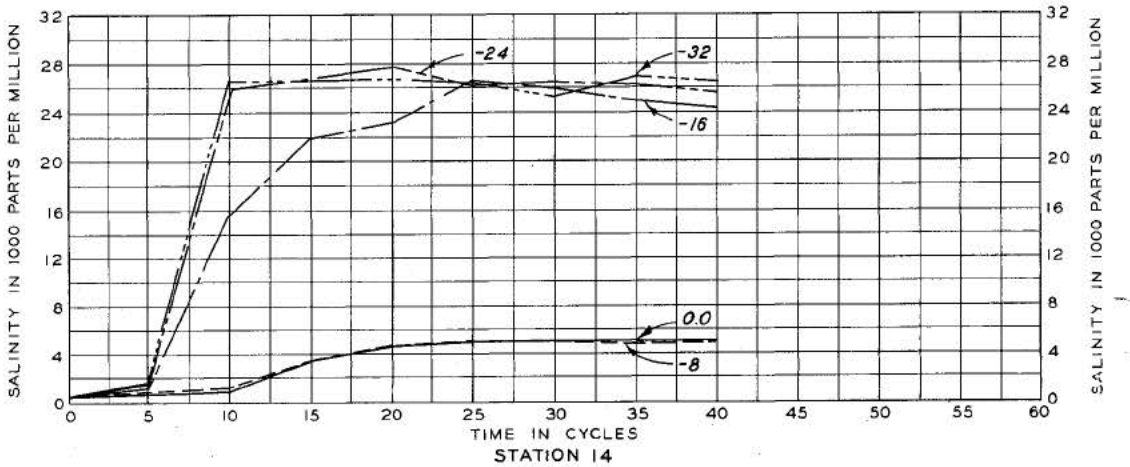
CALCASIEU RIVER DISCHARGE-1000 CFS
34-FT CHANNEL CONDITIONS
TEST 22



STATION 12



STATION 13



STATION 14

LEGEND

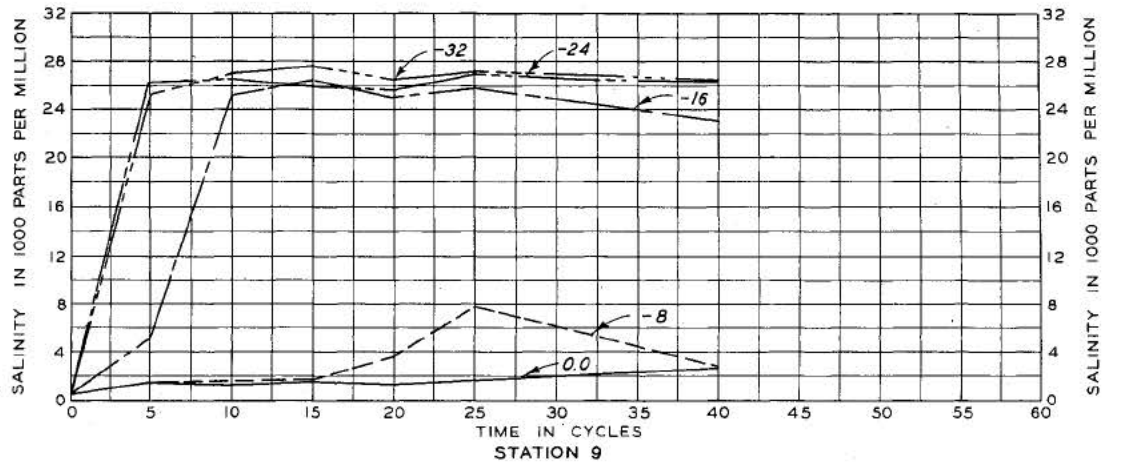
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

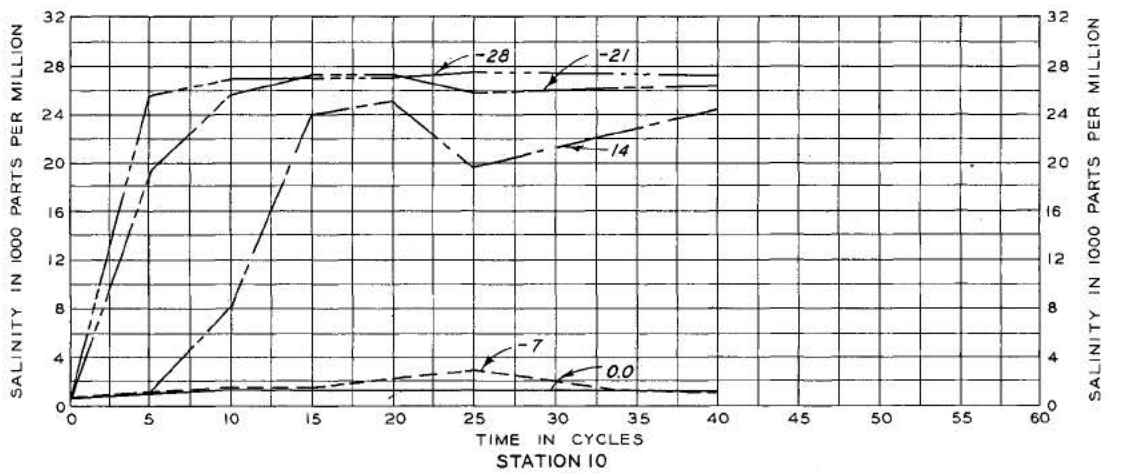
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-1000 CFS
34-FT CHANNEL CONDITIONS
TEST 22

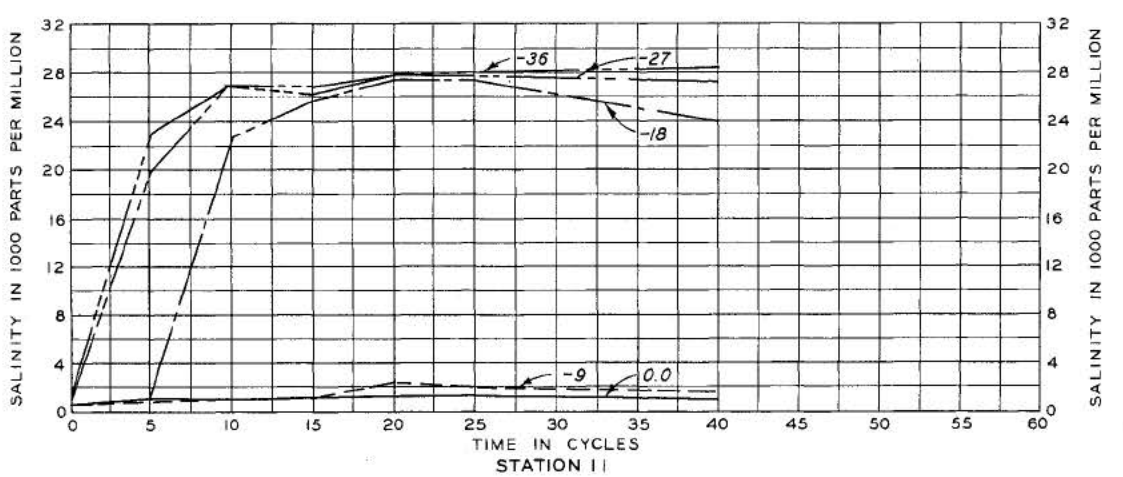
PLATE 80



STATION 9



STATION 10



STATION 11

LEGEND

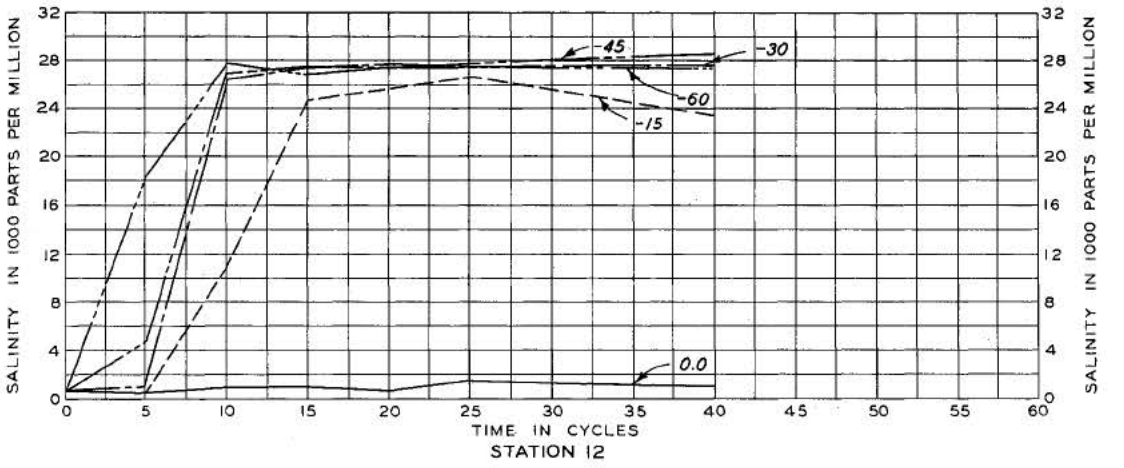
- ——— INDICATES SALINITY AT SURFACE.
- - - - - - INDICATES SALINITY AT 1/4 DEPTH.
- —·—·— INDICATES SALINITY AT 1/2 DEPTH.
- ——·—·— INDICATES SALINITY AT 3/4 DEPTH.
- ——··—·— INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

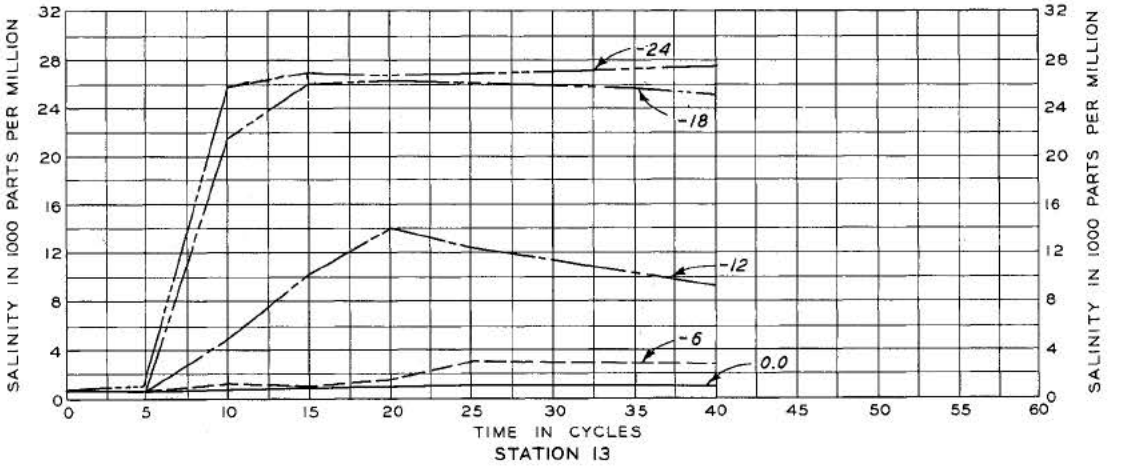
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-2500 CFS
34-FT CHANNEL CONDITIONS
TEST 23

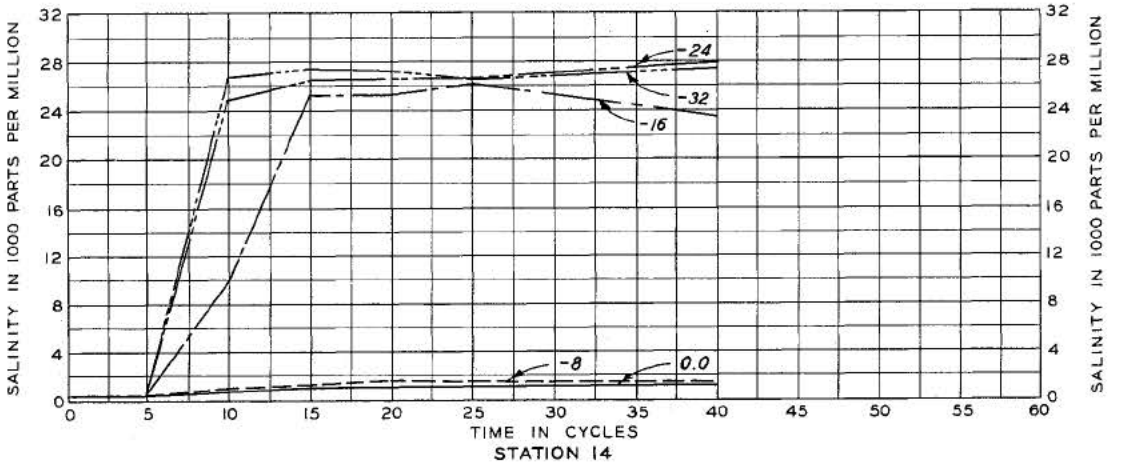
PLATE 81



STATION 12



STATION 13



STATION 14

LEGEND

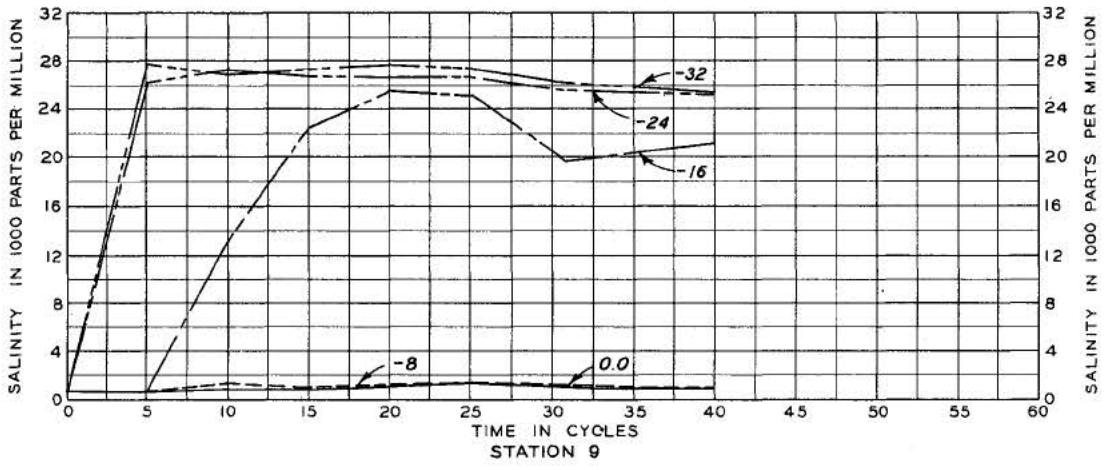
——— INDICATES SALINITY AT SURFACE.
– – – – – INDICATES SALINITY AT 1/4 DEPTH.
——·—— INDICATES SALINITY AT 1/2 DEPTH.
——··—— INDICATES SALINITY AT 3/4 DEPTH.
——·-·—— INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

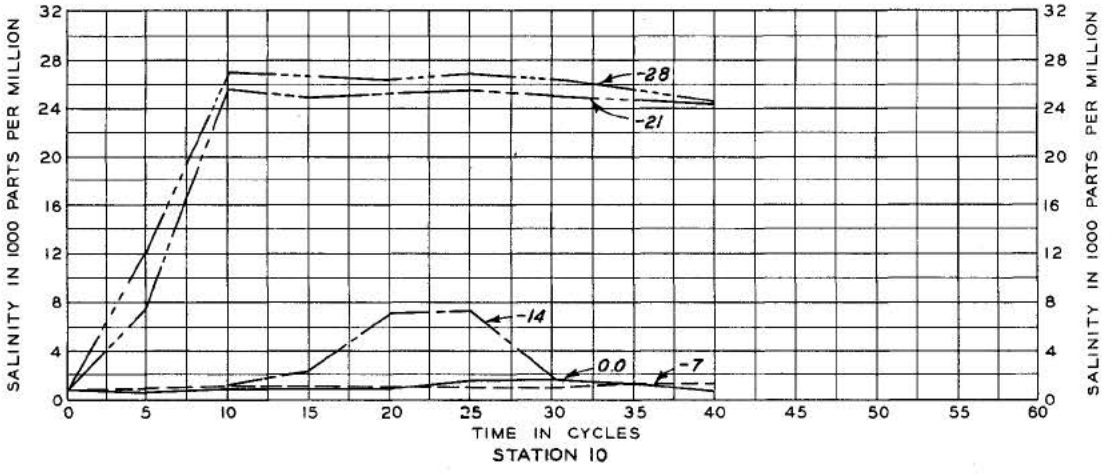
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-2500 CFS
34-FT CHANNEL CONDITIONS
TEST 23

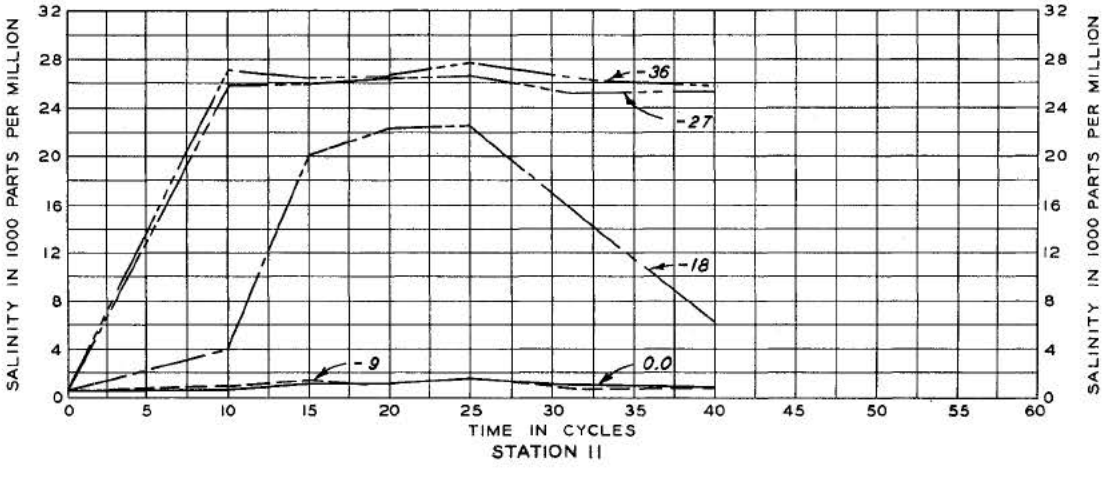
PLATE 82



STATION 9



STATION 10



STATION 11

LEGEND

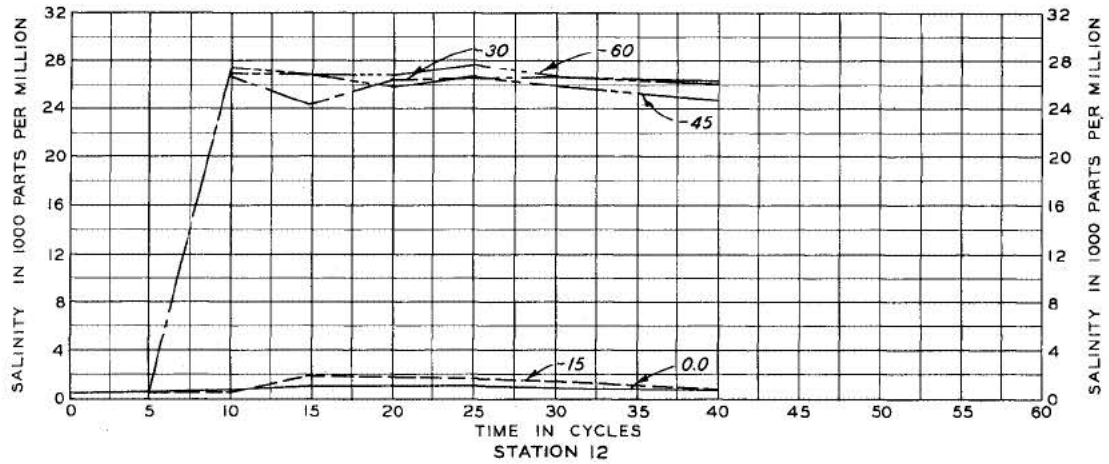
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

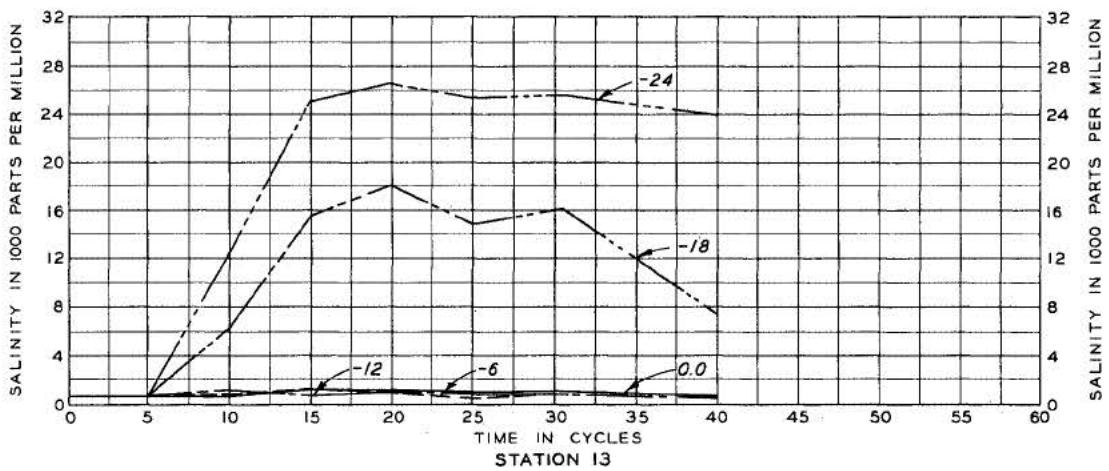
NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

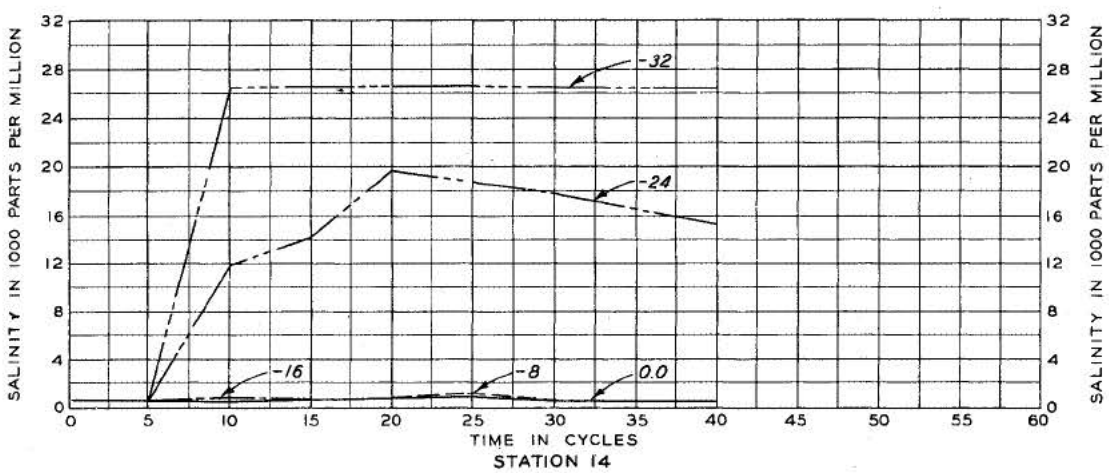
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-5000 CFS
34-FT CHANNEL CONDITIONS
TEST 24

PLATE 83







LEGEND

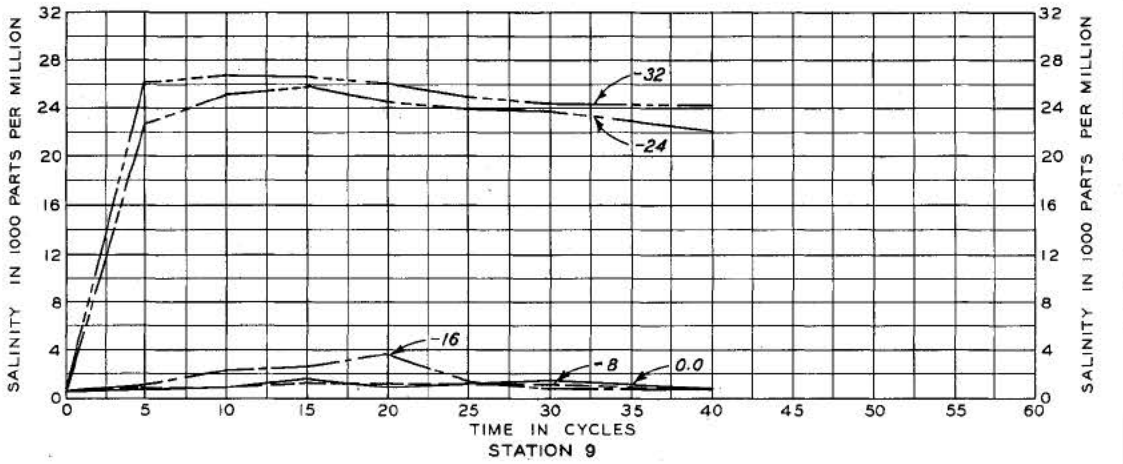
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

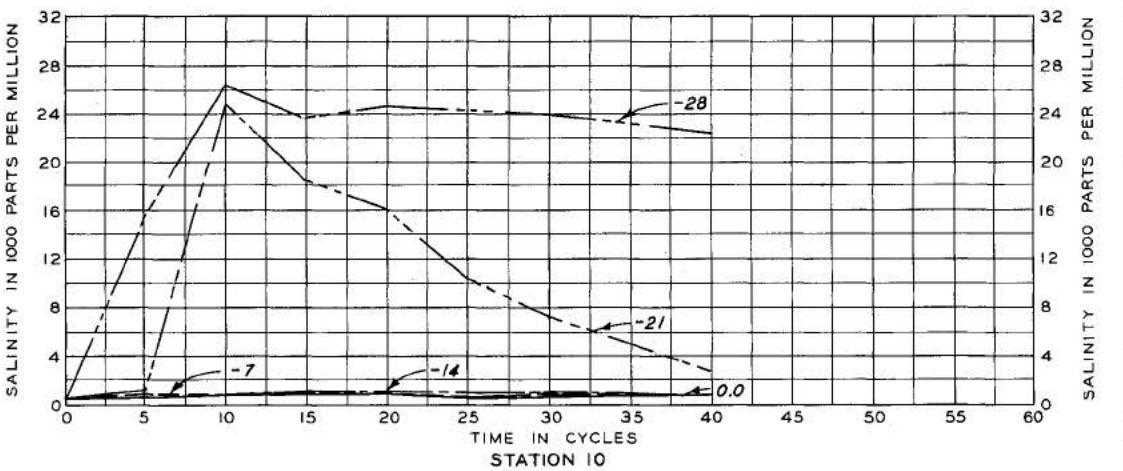
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE 5000 CFS
34-FT CHANNEL CONDITIONS
TEST 24

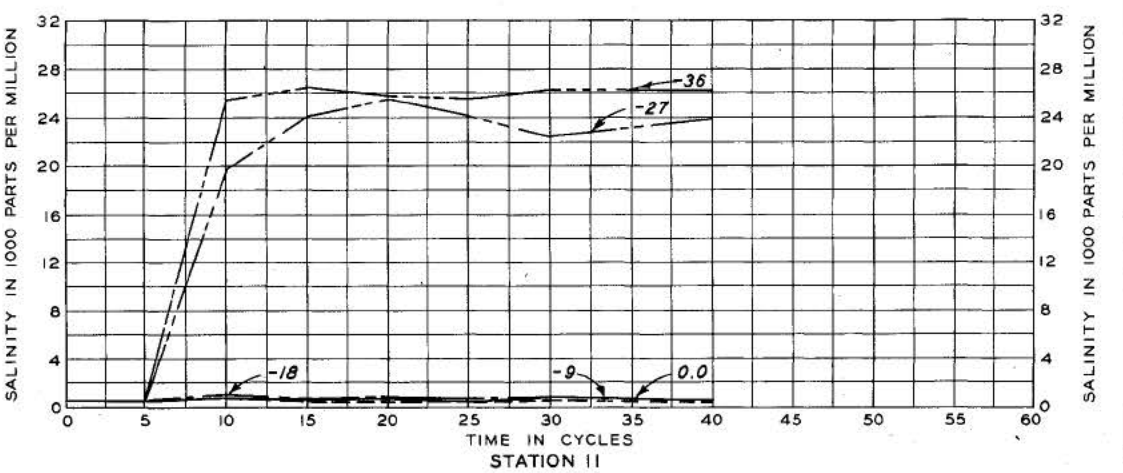
PLATE 84



STATION 9



STATION 10



STATION 11

LEGEND

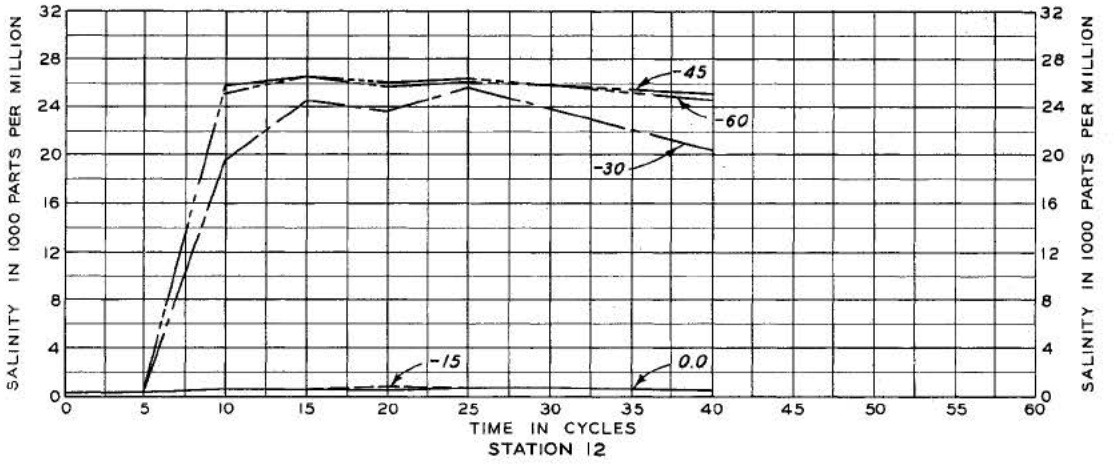
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL

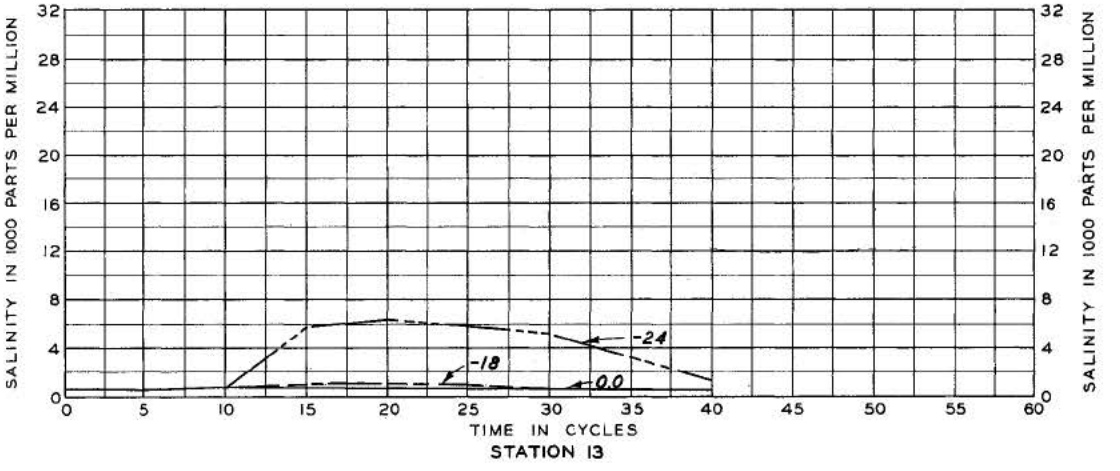
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-7500 CFS
34-FT CHANNEL CONDITIONS
TEST 25

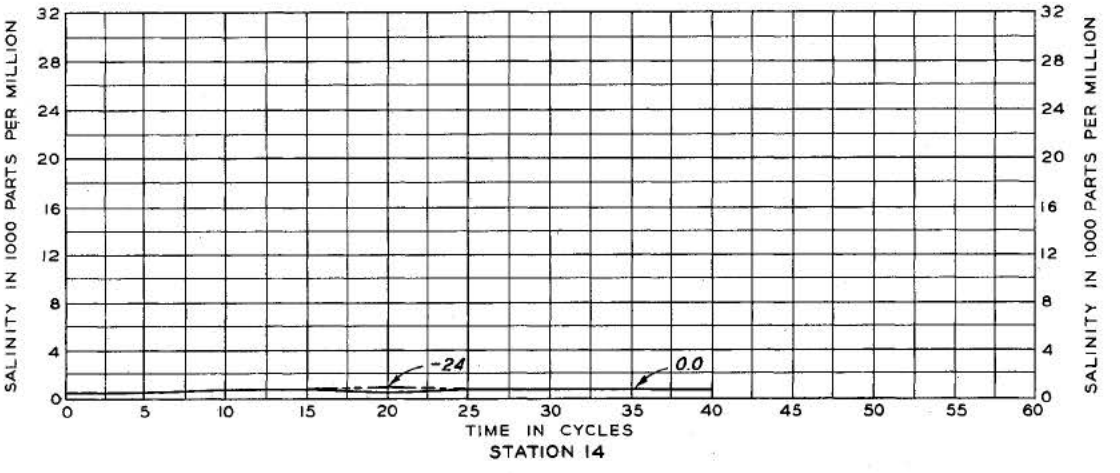
PLATE 85



STATION 12



STATION 13



STATION 14

LEGEND

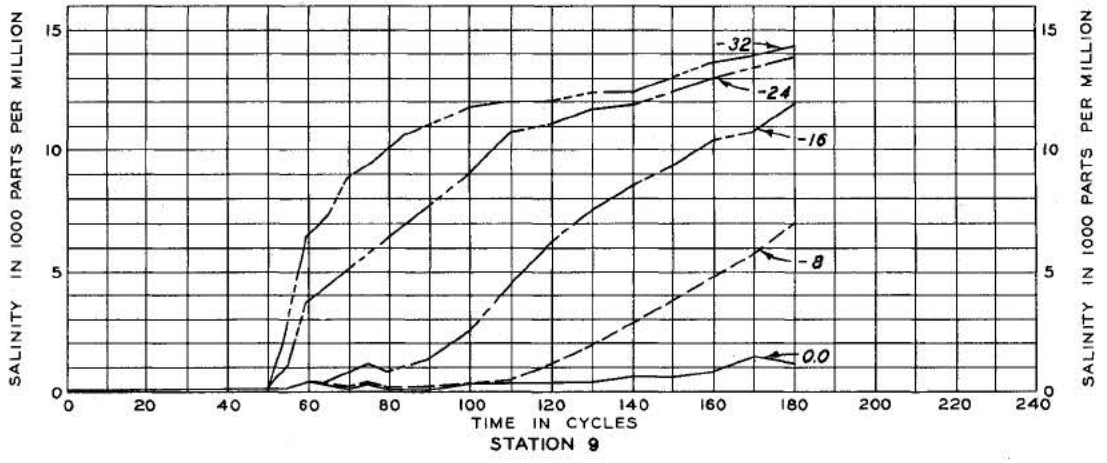
- ——— INDICATES SALINITY AT SURFACE.
- – – – – INDICATES SALINITY AT 1/4 DEPTH.
- —·—·— INDICATES SALINITY AT 1/2 DEPTH.
- ——– —– INDICATES SALINITY AT 3/4 DEPTH.
- ——– – – INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

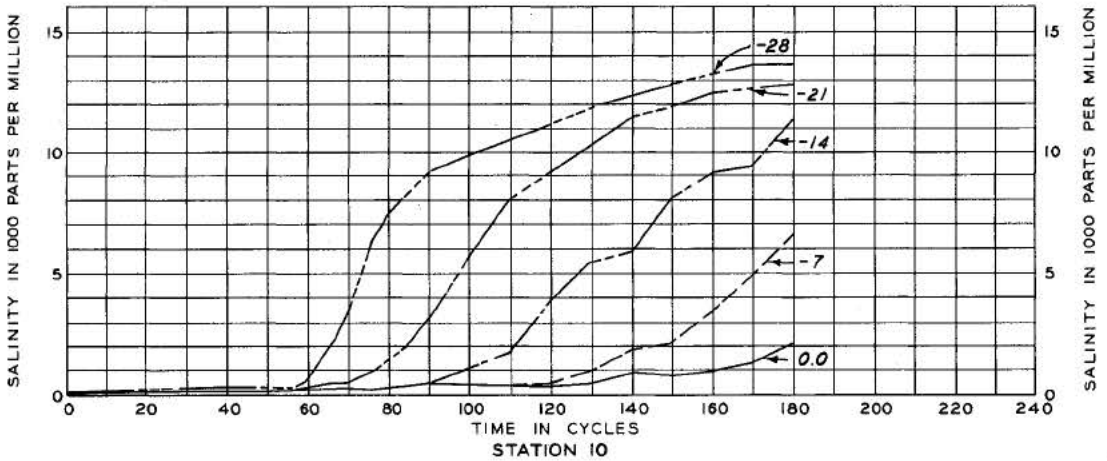
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE-7500 CFS
34-FT CHANNEL CONDITIONS
TEST 25

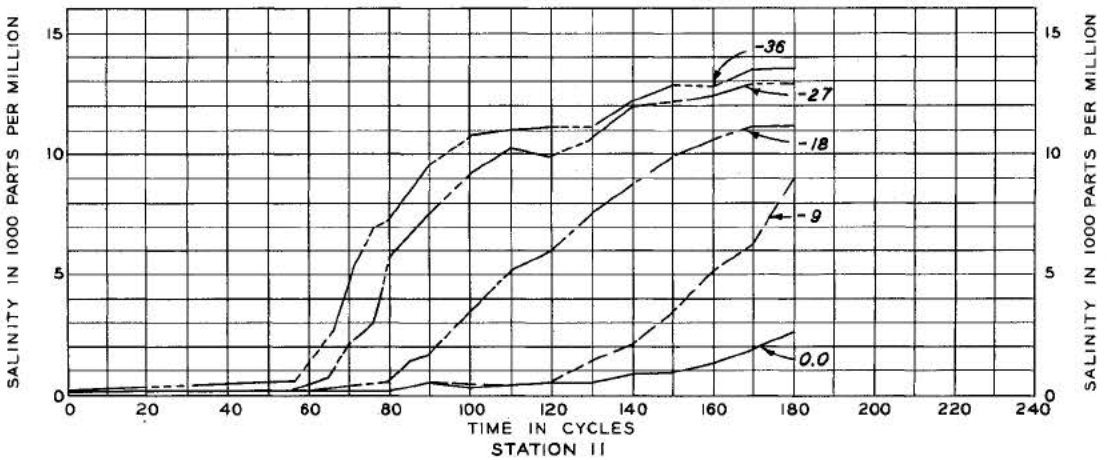
PLATE 86



STATION 9



STATION 10



STATION 11

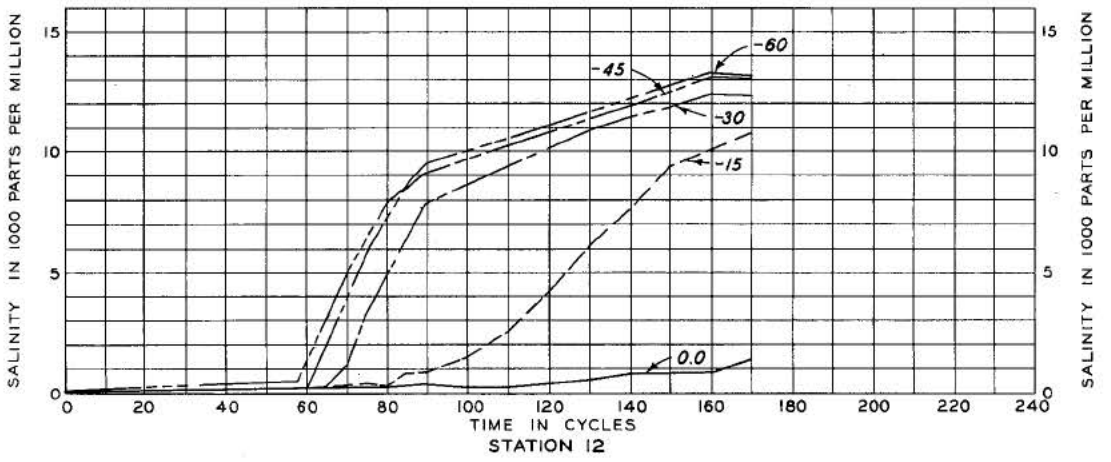
LEGEND

- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

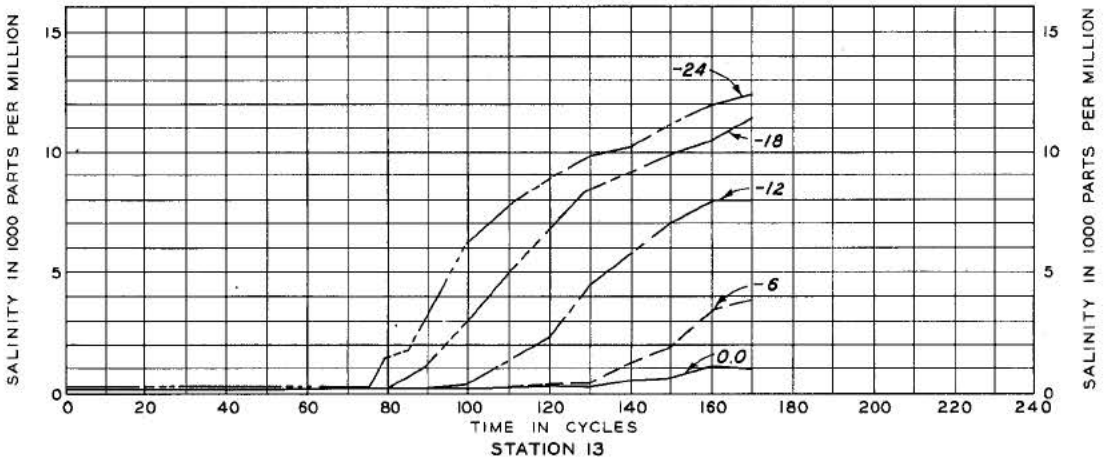
NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

SALINITY OBSERVATIONS

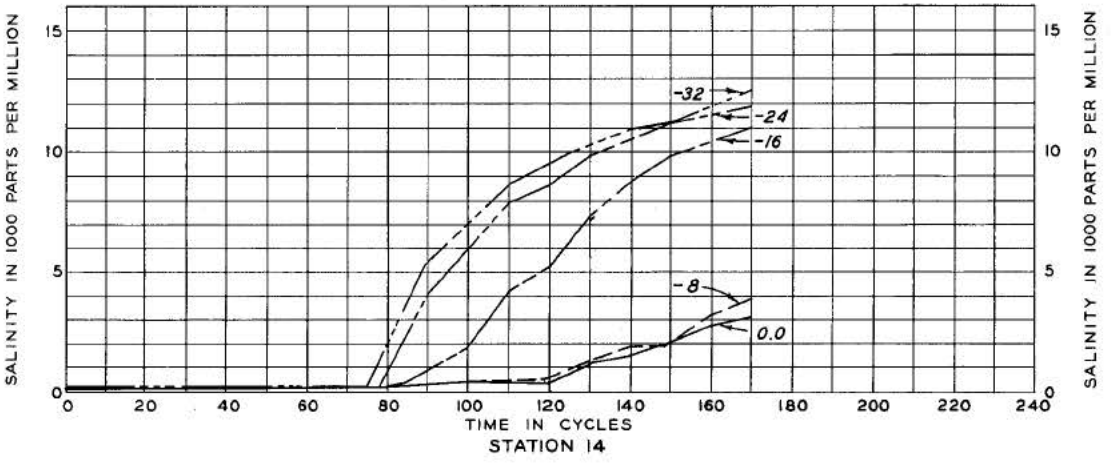
CALCASIEU RIVER DISCHARGE - 500 CFS
1940 CHANNEL CONDITIONS
TEST 26



STATION 12



STATION 13



STATION 14

LEGEND

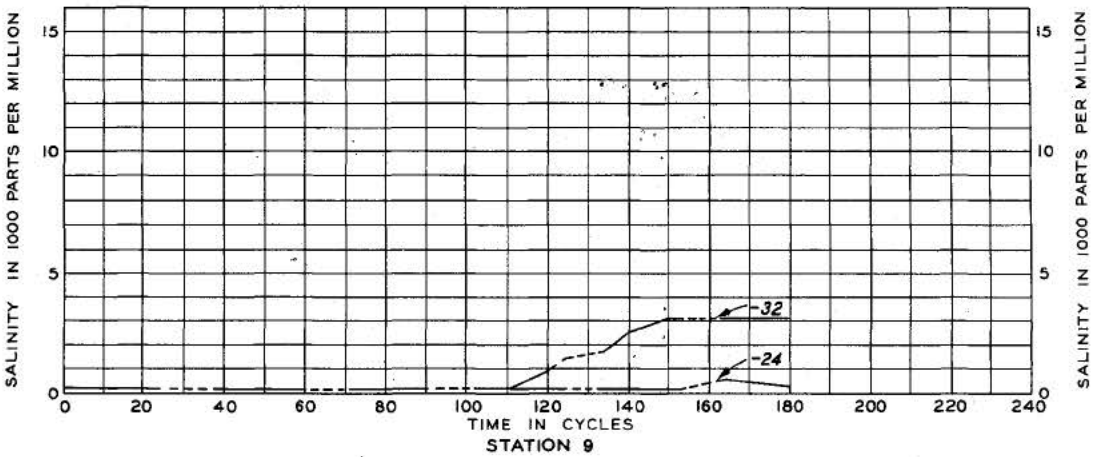
- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

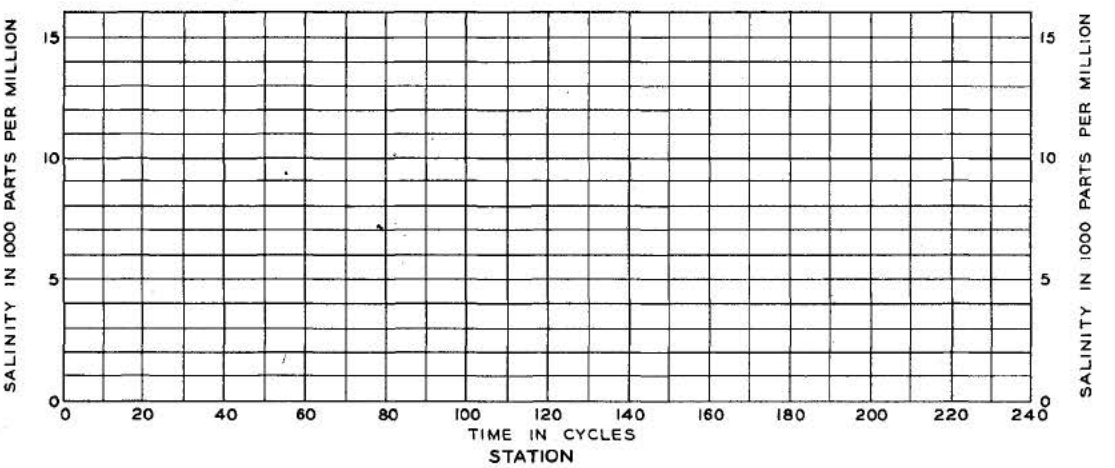
NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

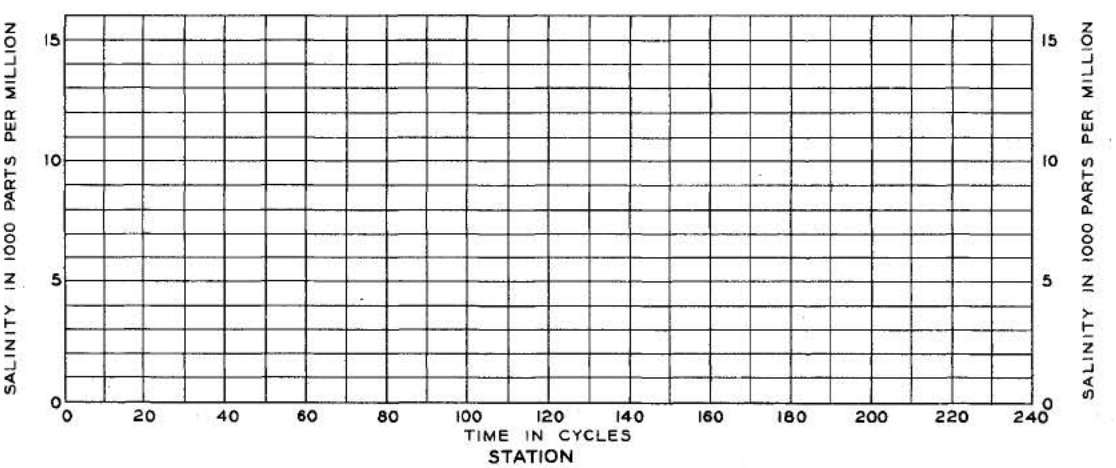
SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE -500 CFS
1940 CHANNEL CONDITIONS
TEST 26

PLATE 88







LEGEND

- INDICATES SALINITY AT SURFACE.
- INDICATES SALINITY AT 1/4 DEPTH.
- INDICATES SALINITY AT 1/2 DEPTH.
- INDICATES SALINITY AT 3/4 DEPTH.
- INDICATES SALINITY AT BOTTOM.

NOTE: ONE CYCLE IS EQUIVALENT TO ONE LUNAR DAY OR 24.84 HRS.
NUMBERS SHOWN ON CURVES REPRESENT DEPTH IN FEET OF SALINITY OBSERVATIONS BELOW MEAN GULF LEVEL.

SALINITY OBSERVATIONS

CALCASIEU RIVER DISCHARGE - 1000 CFS
1940 CHANNEL CONDITIONS
TEST 27

PLATE 89